

BOERHAAVE'S
INSTITUTIONS
IN *Physica*
PHYSICK.

By which the Principles and Fundamentals of that Art are digested, and fully explain'd, as they relate both to the Theory and Practice; all which are establish'd upon the Mechanism and Structure of the *Solids* and *Fluids* that compose an Human Body;

BEING A
COMPLETE SYSTEM

Of what is necessary to be known in
the Study of PHYSICK.

The second Edition Translated,

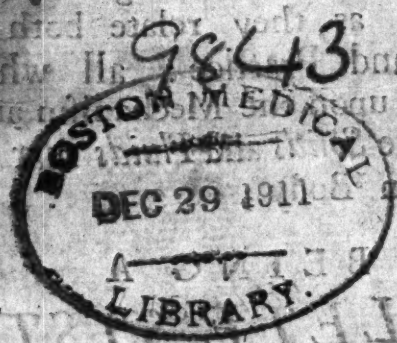
By J. BROWNE, LL. M. D.

L O N D O N:

Printed for Jonas Browne at the Black
Swan without Temple-bar. 1715.

PHYSICK

By which the Principles and Fundamentals of that Art are digested and fully explained, as they relate both to the Theory and Practice, all which are established upon the most solid and secure Ground of the most approved and complete Anatomy and Medicine.



COMPLET SYSTEM

Of what is necessary to be known in the Study of PHYSICK.

Of the second Edition Translated.

By J. BROWNE, LL.M.

LONDON:

Printed for James Browne at the Blue Swan without Temple-bar, 1715.

TO

Dr. *William Maundy,*

PHYSICIAN to the

Royal Hospital at Greenwich.

SIR,

AS You recommended this Subject to me, I have us'd my Endeavor to render it intelligible. I confess it was a hard Task; yet the Pleasure I had in doing it, and the Use I am perswaded it will be of, to the Faculty, especially the young Students, makes me amends for the Trouble, but particularly this of paying a publick Acknowledgment

to an old Friend after five and twenty Years intimate Acquaintance first contracted in the same University and College, from which time we have both pursued the same Studies.

The learned Physician, I presume, will not think this an unacceptable Performance, considering the Author is very dry and confin'd in his Language, tho' the Subject be so copious ; so that it took almost as much Time and Application to translate, as it wou'd have done to have compiled this Work ; for a Man may be very well vers'd in the Latin, and yet not take his Meaning right at the first or second Reading, which tho' it was a Discouragement to the Undertaking, seems to me a justifiable Reason for its appearing thus in English.

*I know You will pardon small
Faults,*

The Dedication.

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Faults, if You meet with the true Sense of this Author in a plain Stile, tho' now and then I am forc'd to make use of more Words than he does, which are Words of the same Signification; this is done, either to render the Language freer and not so stiff as otherwise it must have been, or else to explain the Author's Meaning, and make it more easily understood. I need not mention this to You, (altho' by this I address my self to many) because You have considered the matter already; and I flatter my self, You will not be disappointed in Your Expectations.

These Institutions of Boerhaave's are a Treasury of Medicinal Knowledge, collected from the most judicious Physicians; but as they do not, agreeable to the Nature of the Design, enter into the Practice of Physick, I thought I might without

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prejudice, nay, I doubt not but with some advantage, offer them to the Profession in this Dress: For I cannot conceive how such good Notions and solid Principles, founded upon mechanical and anatomical Observations, joyn'd to Demonstration with a judicious method directing all to Practice, can in any Language be a Dishonour to the Profession, altho' the Art was more universally known, and better understood, than it is at this Day.

I speak now to one who knows the Education of young Students in Physick abroad as well as at home, and on which side the Advantage lies: I hint not this to the Disparagement of our own Universities, which I stand engag'd to; but 'tis a difficult matter for those who are left to their own Studies to put themselves in a regular method,

The Dedication. vii

thod, they may read till Dooms-day, and not arrive at a tolerable Judgment in the Profession, if they do not apply the Theory to the Practice and the Practice to the Theory; and this for want of knowing how far Anatomy, Chymistry and Pharmacy are necessary, and how to adapt them properly.

'Tis rambling Work to learn all these at second hand, or according to Mode, to go a Course of Anatomy, Chymistry, Botany, and yet know nothing of the matter, that is not experimentally, either how to work with their own Hands, or how to apply what they have seen or read. What useful Discoveries have we lately met with from the dissecting Anatomist? or what better methods of Cure from all his Discoveries? What efficacious powerful Medicine hath the Chymist found out for Gout, Stone

viii The Dedication.

Stone or Dropsy? *What have all our Botanick Virtuosi discover'd to cure a Corn, or ease an aching Tooth? If this is not the end of our Enquiries, why do we enquire at all? Why do we not dully tread in the Steps of Antiquity, and never pretend to be better Physicians than our Forefathers.*

I must not here forget to congratulate Your being plac'd in a Station, wherein You have an Opportunity put into Your Hands of doing Service to Your Queen and Country, by affording speedy Relief to those (otherwise miserable Creatures) who have undergone the Fatigues of a long War, and the Hardships of a Sea-faring Life, by which means they have contracted many deplorable and stubborn Diseases, which will not yield to common Treatment;

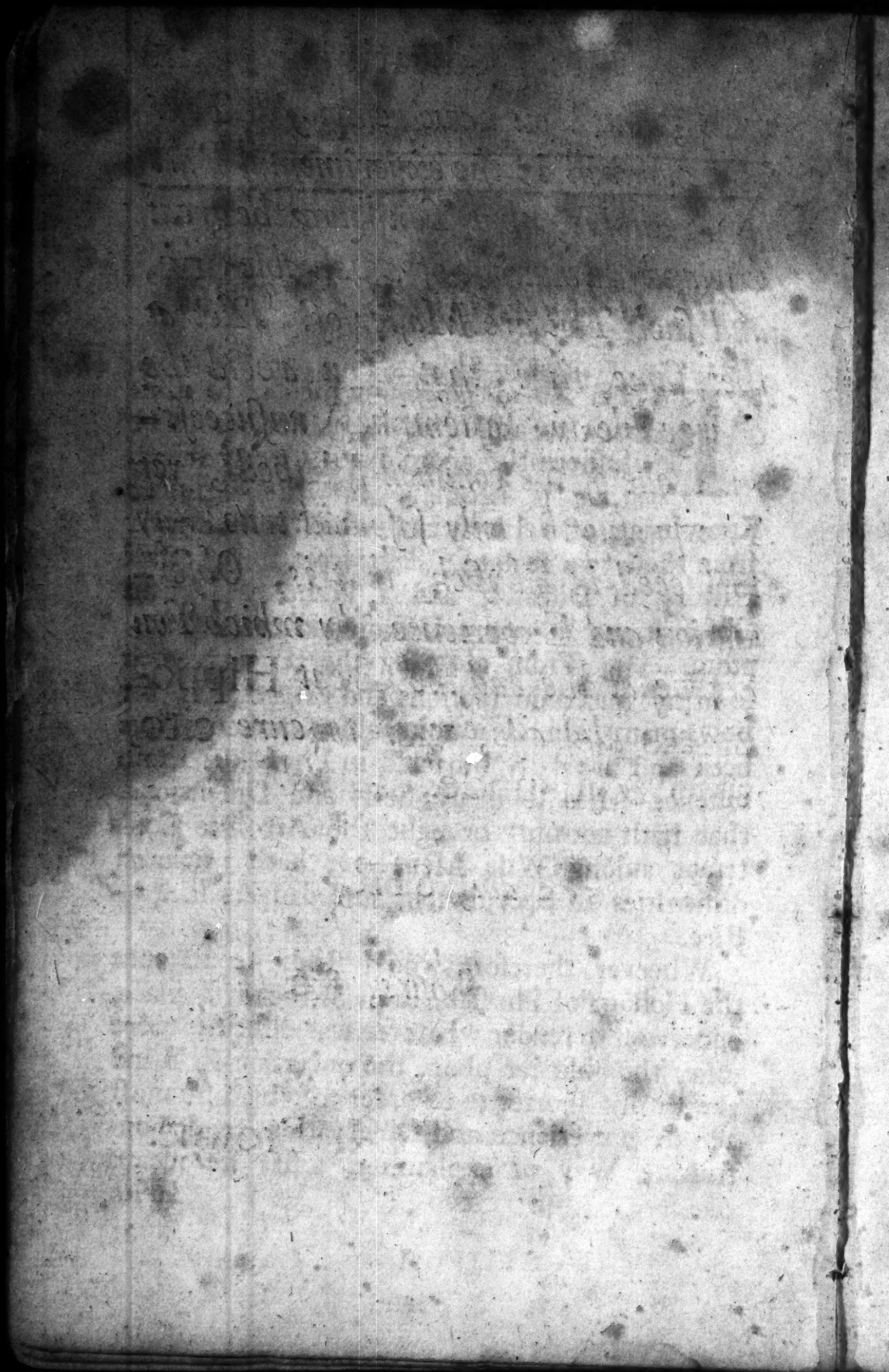
The Dedication. ix

ment; but You have employ'd Your Time so well in the experimental Part of Medicine, that You know the great Use and Advantage of a valuable one, and such You are Master of. Yet at the same time that You avoid the chargeable and (oftentimes) unsuccessful Rode of the common Methods, yet You pursue the only safe and true Way to succeed in Physick, that is, Observation and Experience, by which You arrive at the end the Great Hippocrates did also, viz. to cure cito, tuto & jucunde.

I am, SIR,

Yours, &c.

J. Browne.



An Introductory Preface.

THE *Art of Healing* which is so difficult to attain to, seems not yet to be sufficiently adorn'd with every thing, that is necessary for the exquisite Knowledge of a Physician, which will appear from these two reasons; first, from an imperfect History of Diseases, and a Want of faithful Observations in every Disease and every Symptom. 2ly, From clogging the Theory with so many uncertain Notions and *Hypothesis*; for how many almost innumerable Opinions have been and are daily broach'd in Physick? From whence arises so many Sects and Dissentions, that hath not only brought the Art into Contempt among Wise Men, but hath produced difficulties in Speculation, and dangers in Practice.

Whoever therefore wou'd study to advance the Honour of Physick, must in the first place, endeavour to render whatever was difficult, more easie, the obscurer plain, the uncertain fix'd, and the Prolix shorter: In order to which he must add to Experience and Observation, a demonstrative Way of explaining, what he means
with

with clear Reason and due Connection, for the Advantages that arise from a well appointed and easy Method, in the most difficult Sciences that are taught and acquired, is evidently shewn to us in *Mathematicks*, *Astronomy*, and the new Method us'd in *Botany* of ranging Plants under their several *Classes*.

So that the like may be done in the Art of Physick, for if a Method was invented clear, short and demonstrative, that lays down known *Principles*, and makes the Connection of Causes agree with their Effects, it wou'd be easie then to discover the *Truth* and *Simplicity* of Physick, both in Theory and Practice.

But first, as it is in other Sciences, we ought to make our *Principles* or *Fundamentals* certain and plain Demonstrations; because on them we must explain the Causes of Diseases and the Nature of their *Cures*, which is no more than reasonable Philosophy.

What must we think then of the several *Principles*, which have been establish'd in all Ages, as the *Basis* whereon to account for Diseases, and the Art of *Healing*. The Antients introduced the Elements and their four Qualities, from whence they derived their *Temperaments*; others have brought in *Innate Heat*, *Radical Moisture*, a *Presiding Spirit*, *Astral Powers*, *Nature*, &c. all which have been laid down as Fundamental Principles in the *Theory* of Physick.

The Moderns who endeavour to refine the Art by Fire, have fix'd their *Principles* upon *Salt*, *Sulphur* and *Mercury*; others again upon *latent Seeds*

Seeds, Idea's, Archea's, occult Ferments, &c. but some pretend to account for all the Effects of Nature by *Acid* and *Alcaly*; many have formed an universal *Pathology*, from a *Triumvirate* of Humours, to wit, the *Bile*, the *Pancreatick Juice*, and the *Pituitary one*.

At this day, when Experimental Philosophy hath so much obtain'd, and the *Phænomena* of Nature are explain'd from the Figure of the *Particles* their Size and Situation; there are many will derive all the Causes of *Diseases*, from *Acrimony*, *Viscidities*, and *Bile*; but what Success there hath been in any of these Opinions Experience proves; for this way of learning the Knowledge of Physick, hath been the occasion of the wide Difference and Contradictions to be met with amongst Physicians: For 'tis evident, where things are not generally agreed on, we have just Reason to suspect, that the *Truth* is not yet found out, or at least not brought to Light.

Some have founded their *Principles* upon an *Entity*, which does not only produce natural Actions, but acts beyond Nature, and also frees the Body from *morbifick Causes*; but we assign the Cause of Action to be quite different here, and that it is perform'd without the Concourse of an *Immaterial* and *Ideal Entity*, but only by *Corporeal Motion* and *Impulse*: And this it is, this same Motion or Determination of Action that dispences Life and Health, procures Diseases and restores to Health again, according to the different degrees of Motion in time and place.

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These things are not placed in the Power of the Soul, but are evidently separated from it, as Experience daily teaches for the Motion of the Body, the vital Parts, Health and morbid Dispositions are not the Effects of the Soul, but things rather depending on meer corporeal Causes, as *Air, Diet, Motion*, and the Structure of the *Solids*, which vary according to Age and *Constitution*.

Notwithstanding all this, those very external and meer corporeal Causes, which dispose the Motion of the Blood, and modifie all the natural Actions after different ways, has a great Influence on the Soul it self, by constituting and ordering its *Functions, Inclinations and Manners*; the Functions and Operations of the Soul being different from those Motions which preserve Life and Health, and produce Diseases; in a Word from the Motion and Texture of the Blood, by which we have a curious Natural and Geographical Observation, that as there are different Situations or Regions to the *Poles* or to the *Æquator*, so Men, according to the Structure of the Body, Strength, Disposition of Diseases, long Life, Fruitfulness, &c. have their Wills, natural Inclinations, Vices and Manners distinguish'd.

But tho' the *Soul*, whose Duty it is to perceive, direct and make a Judgment of the several Motions of the Body among one another, and from thence to form Impressions and *Idea's*, does act differently in *Cogitations*, by Virtue of that Union between *Soul* and *Body*, this kind
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of Motion of the *Soul's* is liable to be disturbed and molested several ways, as by the many *Phantasms* and Passions of the Mind; notwithstanding which, the *Soul* does neither directly nor proximately move the *Fluids* of our Body, and perform *Secretion*, *Excretion* and *Digestion*; for which reason it can never be admitted as a *Fundamental*.

A *Fundamental Principle* ought to be Natural, and therefore Mechanical, arising from *Matter* and *Motion*, or the Disposition of Body to *Motion*: For all Actions, as in the *Macrocosm*, where all things are dispos'd in Order, so they are in the *Microcosm*, a *Species* of *Motion*, and the Cause of them only to be found in *Motion*. But it is evident to Reason as well as Experience, that *Motion* is *innate* to all Bodies, but that the subtiler Bodies are swifter, and the solider move with greater force, by which means one acts upon another.

But those Motions which are perform'd in certain Order, certain Proportion, and certain time, are regular Motions, and only depend on the Artificial Structure, Disposition and Proportion of the solid and fluid Parts to Motion, which being alter'd by external and mechanical Causes, make Irregular or Diseas'd Motions, which being restored by Diet and Medicines, are reduced into Order again.

Therefore *Hippocrates* wisely held, that Nature was the Physician and Healer of Diseases, that the *Soul* never ought to be admitted as the Foundation of any thing in Physick, and what
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the Antients ascrib'd to Nature we do to the Structure of the *Solids* and Motion of the *Fluids*.

Hence an universal Principle may be establish'd, from whence the Actions, as well Natural as Preternatural, may be accounted for from this Spring, as from a Fountain Head; and all those things which happen in the Cure of Diseases and the Operation of Medicines. For the Motion of the Blood depends on the Motion of the *Systole* and *Diastrale* of the muscular and moving Fibres, as also on the Temper of the *Fluids* and their Quantity. But the Motion and Impulse of the *Solids* is no *Immaterial Ideal Entity*, but the most subtil material one that can exist, and this is that *Catholick Fluid*, which is the most active from its *Elasticity* or spring of subtil ethereal Air, which the Antients call'd their *Anima Mundi*, we the *Breath of Life*.

For as this *Subtil Elastick Air* is exhaled or drawn off from the Juices of the Body, so Life perisheth; a vitiated Air disturbs both the Body and Mind, in the Performance of their Functions; therefore it is, that from a serene and pure Air the Body enjoys longer Life, and is less subject to Diseases; nay, it is more easily relieved and cured in the most difficult Distempers, to the better Understanding of which, I shall premise two or three things briefly, concerning *Life* and *Death*, *Health* and a *Disease*, on which the whole Structure depends.

Life in the Organical Body does not properly and singularly denote its healthful and uncorrupted State, but as it hath been received in
all

all Ages, it imports a certain Action, which in Physiology is no other than Motion.

Therefore *Life* is a constant Progress of the *Fluids* by certain Pipes or Vessels, assisted by the Impulse of the *Solids*, preserving a corruptible Body from Decay ; so long as such a Motion is in being, so long a Part or the whole Body is said to live, and is free from Corruption ; but as this Motion is interrupted so as not to be restored, the Body is said to be dead ; but so, that Corruption and Putrefaction does not immediately follow ; as we see in Persons strangled, and those who are suffocated with Water, or that perish with Cold, whose Hearts or great Vessels are fill'd with Blood that stagnates there.

But if Death ensue from the Violence of a Disease, this proceeds from a deficient Motion of the Blood, upon which there immediately follows a Disposition and Tendency to Putrefaction ; so that it can scarcely be imagined what Corruption exhales from Bodies in Fevers and the like ; for this Motion of the Blood preserves the whole Body from a State of Corruption, which it would otherwise be subject to.

And altho' this Motion be circular, it is also intestine, which arises from the Motion of the spiritualizing Parts, which defends the Blood and all the *Fluids* of the Body from another Action of external Air, and gives it a different Texture. For by means of the Resistance of this intestine Motion, spirituous Liquors and generous Wines are converted or

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chang'd by the Fluid of the Air into a vapid and insipid Body. Besides the Progression and Pressure of the Blood thro' Strainers of different kinds, separates not only the subtil, airy, active Element, but also the serous, impure, saline, sulphureous Parts, which of their own Nature break through and tend to Corruption, for so long as the *Fluids* are kept in Motion, so much less are they subject to be broken.

Having given the reason of *Life* and *Death*, it follows from the same Spring, to wit the Motion of the Blood, that we should explain the Nature of Health, which does not simply consist in the circular Motion of the Blood, which is also in Sicknes; but it is found in a certain Order and Regularity of this Motion, in a moderate and free Progression of the Blood, assisted by the Pulsation of the Heart and the very Tone of the Fibres, or from the Equality of the Motion of the *Solids* and *Fluids*.

This Equality governs all Actions according to that Order and Law, that was first appointed by the great Creator; in perfect Health, the Soul reasons right, the Senses are vigorous, the vital Motions necessary, Secretions and Excretions are duly perform'd by their proper Emunctories, Sleep, Appetite, Digestion and Nutrition, are all natural and pleasant.

But how this regular Motion of the Blood affects the Government of the Body, we shall more particularly enquire into: There are three Sorts of Parts in Animal Bodies, the *Movers*, the *Parts moved*, and the Way or Vessel by which

which there is a Motion of the Fluids : The *Movers* are the Heart and muscular Fibres of the whole Body, made up of sensible Membranes, and fleshy or carnous Threads, strengthen'd by the Fluid of the Elastick Air in the Blood, which the Antients call'd *Spirit* ; these animated Fibres as I may call them, fitly adapted for Motion by their Constriction or *Systole*, impel the Fluids of all kinds thro' their Vessels, and these moving circularly, support and nourish the particular Parts of the Body ; the *Part moved* are the *Fluids*, the Blood with its *Serum* and *Lympha*, together with whatever Humours arise from them ; the Ways by which they move one way or the other, are first the Arteries, which bring Blood from the Heart as the Fountain or first Muscle of Motion, then the Veins and lymphatick Vessels, which convey Blood and *Lympha*.

Now every Man may easily conceive, how a moderate and free Motion of the Humours, requires a moderate and equal Impulse of the *Solids* ; that is, not too swift and violent, nor too slow and weak, but which keeps Proportion by just Intervals ; from hence a proportionable Quantity of Humours is required for the Vessels and for the Strength of the Fibres ; besides this, a due Proportion of Elements, such as are necessary to temper the *Fluids*, which compose the Blood : Again, the Passages or Vessels ought to be free, that the Blood may pass thro' them without hindrance.

If all these Things are dispos'd right, the Motion of the Fluids through the Canals and Ducts of the whole Body will be regular, smooth and equal, which is the Perfection of all Actions, that are perform'd in us according to Nature. But because the impelling Parts or moving Fibres to impulle, particularly relate to the Circulation of the *Fluids*, it will be necessary that we form to our selves clear and distinct Notions concerning this Impulse and Motion; *viz.* that we assign the first Place to the *Heart*, as the *primum mobile*, the Prince of the Muscles, the first Impeller, and consequently the Fountain of Life.

This Noble Muscle triumphs over all the rest, as having two different Motions, upon which all the others depend, the one is active from the *elastick Fluid*, existing in the Fibres, which is call'd the *Systole*, for by this means they are contracted and straitned, and so the *Fluids* lodging in their Cavities are propell'd and driven forward, the other Motion of the Heart, to wit, its *Diafsole* is passive, because the Fibres are relaxed and dilated from the Impulse of the Blood into its Cavity: Therefore the Blood is received by one Motion, and expell'd by the other, from the Blood's being puls'd out of the Heart, the Arteries are dilated, but contracted from the proper *elastick Fluid* of the Fibres, by which they protrude or thrust forward the Blood into the Veins; but the Dilatation of the Arteries from the Blood being impell'd into them from the Heart, is by the Physicians call'd
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the *Pulse*, by way of Eminence or Distinction, for you can scarce perceive the *Systole* by any Sense of feeling.

Besides this *Pulse* and *Motion* of the Arteries, the venous, arterial and lymphatick Ducts are confirm'd by that Motion, which exists in every Species of the *Systole*, and is call'd the *Tone*, as the turgid Fibres in the elastick Fluid of the Nerves and Blood, not only promote the Circulation and Progression of the Fluids by their Strength and Retension, but by a certain subtil Impulse; again, the Fibres are also confirm'd in the *Motion* of the *Diaстole*, which is made from the Impulse of the Blood by the Heart, extending and dilating the Fibres, which if the other cannot resist, to wit, the *Tone* and Strength in the Muscles, the Expansion of the Fibres is then beyond their Spring, and the Progression meets with an Impediment.

Therefore these two kinds of Motion, viz. a *Pulse* which exerts its Power in the Vessels and the Heart, and drives from the Centre to the Circumference, and the *Tone* which is seated in all the Fibres, membranous and muscular Parts, and moves from the Circumference to the Centre; if these are in a right State and in due Strength, Equality and Temperament, the Blood is received into the Parts equally and without Impediment, and from the same, a due Quantity is expell'd in due time, the Secretions naturally follow, and so the Business of *Health* is perform'd.

A Constitution or Temperament of Body, physically consider'd, is nothing else but a particular or distinct Motion in different Persons; for when the Blood is swiftly and violently moved, and is too fluid: This, according to the Antients, was call'd a *choleric Constitution*; if less fluid and the Motion slower, *melancholick*; if weak and languid abounding with serous Blood, *flegmatick*; if the Blood was too plentiful and mov'd briskly thro' the Vessels, then *sanguine*.

This Variety of the Motion of the Blood depends not so much on the Quantity and Size of the moving Fibres, but on their Strength and Vigour; and therefore consequently on the *Pulse* and *Tone*; in the next place, it depends not on the Substance and State of the Blood, the Plenty of the Vessels, their Capacities and Condition; but as an hereditary Disposition, Age, Sex, Climate or Air variously affect and alter this Temperament of Humours, the Contraction of the Fibres, the Strength and Habit of the Vessels, so the Motion of the Blood differs, that it is never one and the same in the same Man, at all Times of the Year, under all sorts of Diet, and in every Climate.

But because the Motion of the Blood is so various in various Persons, hence is observable, that Difference in Constitutions, as to Appetite, Excretions, Pulse, Strength, morbid Inclinations, Dispositions of the Mind, and other things of the like nature.

Having

Having succinctly explain'd the Reason of *Health*, it will be easy to descend into the Origine and Cause of Diseases; for the same fundamental Principle from which we deduced the reason of the former, may serve for an Explanation of the latter. For as the very *Being* of *Health* consists in a moderate, free and equal Motion of the Blood, or in the Equality of the *Pulse* and *Tone* of the just Temperament and Quantity of the *Fluids*; so the Seat of every Disease, and the immediate Cause thereof, is placed in the Motion, as it is immoderate, obstructed or unequal, by reason of the lost Distinction of the *Pulse* and *Tone* of the *Solids*, as also the Intemperament and Disproportion of the *Fluids*.

Health is formally the Use or Exercise of all regular Actions, but in a *Disease* this Exercise is either lessen'd, interrupted or totally destroy'd, for there is none, in which either the vital, animal or natural Actions do not suffer. Hence it is, that in every Disease, either Appetite, Digestion, Pulse, Respiration, Nutrition, Sense, Reason, the Secretions or Excretions are wanting: But as the ordinary Motion of the Blood directs its Actions nearest to Nature; so on the contrary, the inordinate Motion is the Parent of all irregular Actions in the Body; for a disorder'd Motion attends all Fevers, Inflammations, Hemorrhagies and Spasms, and a changeable Pulse, Alteration of Heat and Coldness, a Collection of Blood in any Part, vicious Excretions are the

Signatures. For the Parts are too hot or too cold, the Body too much contracted or relaxed, the Excretions too plentiful, not enough, or else irregular, the Pulse too quick or too slow, Respiration increas'd or abated; these things sufficiently shew a disorder'd and anomalous Motion of the Blood.

Besides, there are chronick Distempers where the Motion of the Humours are obstructed, and where a Relaxation of the Fibres does not attend, and this is plainly demonstrated in Tumours, Extravasation of the Fluids, and the Suppression of necessary Excretions: And this may be derived partly from a lost Tone of the solid Parts, and partly from an undue Proportion and Mixture of the Humours: The Motion of the muscular Parts makes up both the *Systole* and *Diastole*; the *Systole* is injured when it is too strong, violently contracted or wound up so as to force the Spring, and then it is call'd a *Spasm*, or rigid Contraction: The *Diastole* is hurt, when it is dilated beyond its natural State, and then there attends it an Inability to Action from its Relaxation or Weakness.

*The Author's, &c. that were made
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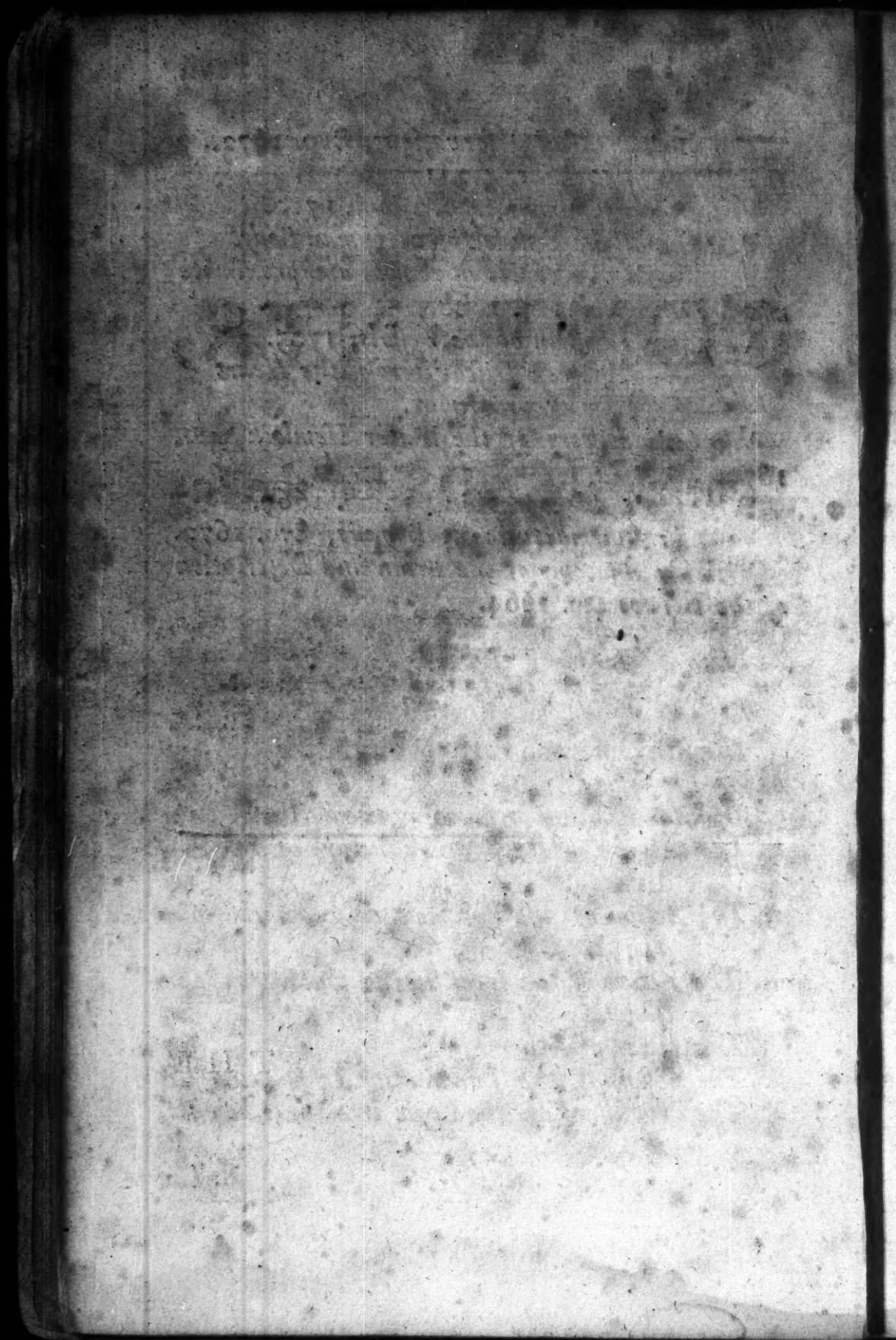
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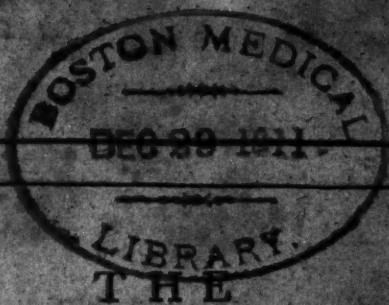
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THE



INTRODUCTION,

*Containing the Rise, Progress, and
Success of Physick.*

Whoever can exercise the proper Actions of Life with Ease, Pleasure, and for some Certainty of Time, may be well esteem'd a sound or healthful Man; and it is this State or Condition only that deserves the Name of *Health*: But if he cannot perform these things, or at best does them with Trouble, Pain, and Weariness, the same may be call'd a *sick Person*, and the Condition he is in, we are us'd to term a morbid State or Disease.

But Injuries from Accidents and the unavoidable Vicissitude or Change of things, which are always necessary, as Air, the Quality of Meat and Drink, the Force of external Bodies, the Actions of Life, and lastly, the Fabrick or the Composition of Human Bodies have render'd Diseases coequal with Mortality, as long as we enjoy Life under the Necessity of that Law. Indeed Diseases by a mechanick Impulse force the Body to apply some Relief in Men as well as Brutes, tho' Reason cou'd never yet direct us into the manner of it; which would otherwise be unknown; which by Observation we find to be true:

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The troublesome Perception we feel in some Member or Limb being obstructed in its Motion, or the Pain and Torment we perceive in some Part hurt in its Action, strikes the Mind with a Desire to seek for, and apply such apt and proper Remedies as may remove its Grievances, either from uncertain or confus'd Experience, or something it is prompted to, by natural Inclination.

This at first gave Birth to the Art of Physick, and this with daily Improvements was always and in all Places amongst Mankind: But the Monuments of Antiquity, as well solid as fabulous Historians inform us, such as *Herodotus*, *Strabo* and *Pliny*, that the *Assyrians*, *Babylonians*, *Chaldeans* and the *Magi* first cultivated this Art, in order to cure the present and prevent future Diseases. Hence the Art spread it self according to *Homer* in his *Odyssees*, and *Diodorus Siculus* into *Egypt*, then as *Herodotus* writes into *Lybia Cyrenaica*, from thence to *Greece*, as *Hippocrates* witnesseth, where it first flourished in the Islands of *Cnidos*, *Rhodes*, *Coos*, and *Epidaurus*.

The first Foundation of the Art was built upon Chance, natural Instinct, or unforeseen Events, which was afterwards improv'd; first, from Memory, or the Recollection of what Success they had from former Experience. 2ly, From describing the Disease, Remedy and Success, which, as *Pausanius* takes notice, was wrote upon the Columns or Pillars, *Strabo* says upon Tables or on the Walls of the Temples. 3ly, From the Description or Account of the Sick themselves, who, both as *Herodotus* and *Strabo* mention, were expos'd in the Streets and the Market Places, to ask of any that pass'd by if they knew of any Remedy that wou'd cure them, as likewise to advise them to the Use of it. 4ly, From Reasoning, and comparing of Observations with what was present, and what cou'd

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could be expected hereafter, which is call'd the Analogical Part.

Hence the Art arose to a greater Perfection, first from the Application of the Physicians, as *Aristotle* observes, as well to certain Diseases, as to particular Remedies. 2ly, From the accurate Annotation of Diseases: 3ly, The exact Observation and Description of Medicines and their singular Uses. But this presently got into certain Families and among the Priests, who made no small Profit and Advantage of it to themselves; and this soon put a Stop to the Progress and further Advancement of Medicine at that time.

The examining the Entrails of Beasts by the Priests; the Method of embalming and preserving of Dead Bodies, even the killing of Meat for the Shambles, have much promoted the Knowledge of the Structure of a sound Body, the secret and hidden Causes as well of Health, Diseases, and even Death it self; lastly of all, Live Dissections of Animals in use amongst the ancient Philosophers, as *Hippocrates* writes in his Letters to *Damagetus*. 2ly, Lectures or Readings upon the distinct Causes of Diseases, their Rise, Increase, Height or Strength, Declination, Period, Change or Effects. 3ly, The Knowledge of Medicines, their Choice, Preparation, Application, known Virtues or Observation upon their Effects, seem to have render'd the Work perfect.

But *Hippocrates*, who was contemporary with *Democritus*, and who was perfectly vers'd in all these things mentioned as necessary to the Art, and having added thereto his own judicious Observations, compiled there from a Body of Greek Physick, because as he understood the Emperical and Analogical Parts, and being an exquisite Philosopher, he establish'd to all succeeding Ages, that which is call'd the dogmatick Physick.

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Which continuing a long time among the Descendants of *Aesculapius* uncorrupted, was at last digested into one common Body by *Aretaeus* the *Cappadocian*; which being in various Parts, was by diverse Artificers at different times, according to the Success of things accurately wrought up, at first in the *Alexandrian School*, 'til at last it came to *Galen's* Hands, who collecting the scatter'd Pieces, digesting the confus'd, and explaining all the rest by the peripatetick Dogma's or Opinions, he enrich'd himself, but impoverish'd the real Art of Healing, by adding more Difficulties thereto, and clogging Medicine by his subtle Innovations of Elements, Cardinal Qualities, and the four Humours.

But the Memory of these things being almost worn out with other Arts in *Europe* after the Sixth Century from the Ninth to the Thirteenth, Physick was more subtilly improv'd by the Arabians in *Asia*, *Africa* and *Spain*, whilst the *Materia Medica*, the several Preparations thereof and Chirurgery received many Additions and Corrections from them together; but tho' the Faults of *Galen* were rather cherish'd and improv'd than banish'd from the Art, yet every body follow'd them, 'til by Emendations and Refutations, there was a Medium fix'd upon betwixt the Two Extremes, and the Discipline of *Hippocrates* gain'd a mighty Restoration by the French Physicians, who added thereto Chymical as well as Anatomical Experiments; 'til the Immortal *Harvey* by his Demonstrations that overturn'd all the Theory of those that went before him, laid a new and almost certain Basis to make Physick a Science. Hence at this Day, it is rever'd as free from all Sects, whilst it is promoted and improv'd by certain Inventions or Discoveries, in Anatomy, Botany, Chymistry, Philosophy, Mechanicks, and the Productions of Art which is made use of in the various Experiments. From
whence

Principles and Parts of Physick.

whence lastly it follows; first, that the antient Art of Medicine depended solely on the faithful Collection of Observations. 2ly, That they employ'd their Faculties in exploring the Causes of Experiments, and enter'd into a large Field of Argumentation, or Disputes about the *Rationale*; so that, 3ly, the first Part was not so fallacious, but always appear'd the same from Evidence, Use and Necessity, but the latter was doubtful, uncertain and changeable, being liable to be controverted or evaded by the Variety of Opinions in every different *Seet of Philosophers*.

The Principles and Parts of Physick.

FROM the useless and fallacious Part this *Science* receiv'd many things, which as they are to be rejected and thrown aside, we are to consider, the whole Scope or Design of this Art is to free or deliver us from Pain, Sicknes and Death; and consequently is instituted for the Preservation of present Health, and the Restitution of that which is lost; and therefore whatever is to be learnt and perform'd by the Physician, is to answer this End. For the Life, Health, Diseases or Death of Mankind is the Object thereof; the Causes thereof, from whence they proceed, and the Means by which they are govern'd: From whence Medicine becomes the *Science* or Knowledge of those things, from the effect of which Applications a healthful State of Life is continued, and the Sick restored to their former Condition; so that the Nobility, Usefulness, and Necessity of this Art naturally discover themselves.

The solid Fundamentals or Principles are to be discover'd two ways, to come at a Certainty: first, from an accurate Observation of those *Phænomena*, which appear in Health, Sicknes, Death & Cadaver,

ver, or else to the external Senses; whether they arise from what is in the Man himself, or from those things which act upon him by external Causes, Accident or Art. 2ly, From a severe or exact Scrutiny into those things which lie hid from our Senses, or are perform'd for some certain End. But these things can only be obtain'd by correct Reasoning, while the Experiments laid down, are distinctly examined in all their several Properties, from thence diligently compar'd among themselves, as agreeing or differing, while at the same time they are faithfully set down, that we may be able afterwards to find out what appear'd plain and evident therein; and in this particular, those of the present Age are not less to be depended on than Antiquity.

Therefore that what is enquired after, may be discover'd from what is laid down; certain Principles are requisite, the Knowledge of which amounts to a Demonstration; which Reason requires should be distinct, clear and certain: Such are those which being purely corporeal in Man, are only mechanical and physical Experiments; for these explain to us the general and particular Force and Operation of Bodies. But since there are in Men other things which cannot be understood by those Principles, and therefore not to be explain'd by Demonstration, it will be necessary to use our utmost Reason, if we wou'd avoid Mistakes, but he may easily see that, that considers the following things otherwise demonstrated, and admits as Truths.

First, That Man is composed of Soul and Body united. 2ly, That these two Natures differ from each other; and 3ly, That he hath a Life made up of different Actions and Passions: 4ly, That these so act among themselves, that the singular or particular Thoughts of the Mind are joyn'd to the determinate Conditions of the Body, and so *vice versa*.
5ly,

5ly, While some Thoughts follow from one simple Thought alone, others are only derived from the alter'd State or Condition of the Body: 6ly, Likewise contrary to these Operations, some make a certain Motion in the Body without Attention, Self-consciousness or a Command of the Soul assisting them as a Cause; but there are none raised by the progressive Actions of the Mind, as long as a Man is in a healthful State; lastly, some Concretes or Complications are observ'd from both these. 7ly, Whatever involves the Thought of Man, that only is to be ascrib'd to the Mind, as the Author or Beginner. 8ly, But that which procures Extension or Motion, that is applicable to the Body only, and its Motion as the Producer of it by its Properties, and so ought to be understood, explain'd and demonstrated. 9ly, Neither can Reason fathom from the clearest Nature of the Mind or Body, so far as yet is known to Human Understanding, what things can act or be acted upon mutually with each other.

The utmost or last Result of Metaphysical and Philosophical Causes, inquir'd into by the Physicians, are not necessary, useful or possible. So that he shou'd make Elements, or establish the Origin of the first Form of Seeds and Motion, but he may profitably apply himself to all things that are demonstrable in Anatomy, Chimistry, Mechanicks and natural Philosophy, so far as relates to the simple Events of Facts. Then he ought to begin with things that are most plain, easy to be known and most certain, from which always going forwards with those which are in the next Degree, he may make such an accurate Progress, as to be able to find out such things as are more complicated, obscure and difficult. So let him proceed instructing from Generals to Particulars, 'til he so explains his Discoveries, that the Inventor may proceed from

Particulars to Universals; on all which, method will depend, first we are to enquire into Life, then Health, next Diseases, and last of all Medicines whereby they are cured.

Therefore the first universal Doctrine in Physick is what we call *Institutions*, and this explains, first the Parts or Fabrick of a Human Body; 2ly, Life: 3ly, Health: 4ly, The Effects which naturally follow, and this is call'd the Physiological Part, the Human Oeconomy, or the Doctrine concerning the Use of the Parts; but the Objects of this Part, as they are reckon'd in Method are usually term'd, the Naturals, or those which appear according to the Course of Nature.

The next Part hath relation to the living Body, as first, Diseases: 2ly, The Difference of Diseases: 3ly, Their Causes: 4ly, Their Effects; which is called the *Pathology*, because it treats of Diseases, or the *Pathological Aitiology* when it treats of its Causes *Pathology* or *Nosology*, if concerning the Differences thereof: Or lastly, Symptomatology as often as it explains the Effects thereof. The Objects of this part, are those things which are preternatural or contrary to Nature.

The third Part teaches us the Signs of a Disease, and how they are reduced to Use; either in a healthful or sick Body, as to what the State or Condition is, was, or will be, the Degrees, Order and Effect of Health or Sickness, and this comes under the Denomination of the Seimeiotical Part; the Objects of which are the things call'd Natural, Non-natural and Preternatural.

The Fourth shews us the Remedies and their Use, by which Life and Health may be maintain'd, from whence it is term'd *Hygeinial*, and hath for its Objects the Non-naturals.

Lastly, The Fifth Part instructs us in the *Materia Medica*; the several Preparations of Medicines, and

and the manner of using them in order to restore Health, and free us from Diseases: This is call'd the Therapeutick Part of Physick, containing the Diatetick, Pharmaceutick, Chyrurgick and method of Cure. Therefore we shall proceed according to this Order laid down and begin with the Physiolo- gical Part.

Of Physiology.

THE Human Body is compos'd, as Anatomical En- quires teach us, of Solids and Fluids: The Solids are, either Vessels that contain the Fluids, or Instru- ments so formed, configurated and connected, that certain determinate Motions may be perform'd or exercis'd from this single Fabrick, if any moving Cause concur. For there we find Supporters, Pillars, Clothing or Covering, Partitions, Rollers, Wedges, Leavers, Pullies, Cords, Presses, Bellows, Sieves, Strainers, Canals and Receptacles. The Fa- culty of exercising these Motions is call'd a Fun- ction, which is agreeable to the Laws of Mecha- nism, by which only it can be explain'd.

The Fluids as mention'd before, are contain'd and mov'd within the Solids, and in Motion are deter- min'd, mix'd, separated and chang'd; the Vessels move with the Instruments tyed to them, the Sides of which rub against each other, change, and re- turn to their Place again. These Actions are per- form'd according to the Hydrostatick, Hydraulick and Mechanick Laws, and therefore ought to be explain'd thereby; yet so that the most accu- rate Reason may be given of each Humour and eve- ry Action, that can be required in any kind of Ex- periment.

By the Nature of Human Life, to be under- stood here according to common Acceptation, I mean

mean such a Condition of the Body, as to Solids and Fluids, as is necessary at all times to maintain and carry on a mutual Commerce betwixt the Soul and Body, so that it may continue after some sort or another, or may be restored in some measure; neither is it necessary to be wholly broke or interrupted: But I will not pretend that this is a true Definition of Life, or that I cannot give a clearer Idea of Health than what is laid down before.

But that we may nicely understand, what is requisite in the Body, that these Two may subsist together. First, We are to make a curious Collection of all the Phenomena of Life and Health. 2ly, Enquire into the Subjects in which these are. 3ly, Examine the Causes from whence they proceed. 4ly, The Instruments by which they are made; and 5ly, The Effects which they do produce again.

But since these are almost innumerable, for Method sake we ought to reduce them to certain Heads, that we may treat distinctly of each of them in order. But first let us begin with Corporeals, which are common to Man and Woman, or proper to either; and since all things so cohere amongst themselves, that they move as it were in a Circle, causes and effects acting by mutual turns, whence arises an unavoidable difficulty to find out the order thereof, without transgressing the Method.

Yet the best appears from beginning with the *Aliment* taken in, and then going forward through the successive changes of those things in the Body, till it ends where these very things make the Body it self, and its Actions; for how the Body exists, or is supported from the things it receives, first known to sense, and continually chang'd, and how it acts by the same, will be most easily and clearly discover'd after this manner.

The

The Aliment or Food therefore, is either solid or liquid, and consequently either eatable or drinkable; the primæval matter of which was Water, and from that, what Earth spontaneously produced, as sacred, profane and fabulous History inform us, nay as we may discern from the very nature of the thing it self: Afterwards the Blood of certain Animals, and other parts of them were used to be prepar'd or dress'd together, with such eatables as the Earth afforded; while many, as *Herodotus* says from all Antiquity, liv'd only of Vegetables and Water, which some do to this day; and whole Nations have been contented to live thus: But *Tulpius* tells us, he saw a Man that liv'd of Grass and Hay: Others feed upon Fish only, some Flesh and Milk, while others eat all kinds of things, as Fish, Flesh, Fowl and Reptiles, which Luxury and Gluttony have brought into vogue, and which in all Ages of the World hath been practiced. Therefore with every one of these things alone or mix'd, crude or prepared, raw or dress'd, the Man that uses them lives, grows and is refresh'd: Neither does the variety of Aliment produce any great difference to the nutrition of the Body, either as to matter or action, what then is the faculty in a healthful Man, which from changing such varieties can constitute a Human Body?

Nevertheless, the use of things teaches us this change is better perform'd according to the variety of the Food, or the difference of the Preparation from whence these were subject to alter before they enter'd the Body. Hence ripe Corn, dress'd and ground, mix'd with Water fermented and boil'd by the Fire, is best for the preservation of Health: So the parts of Animals after being clean'd, dry'd, pickled, boil'd, roasted, broil'd, or the like, experience teaches us are fitter for use; Salt, Vinegar and Spice afford us the particular Materials for Sawce, and are the

the Basis of all Pickles or other Preservatives for Meat.

Summer Fruits, if ripe, that is soft easily melt or dissolve, so that they need no other preparation or assistance. But Drink if from a pure Water and running Stream is best crude or raw; if the Water is foul from Insects, or their Eggs floating therein, gently boiling or letting it stand for a time renders it better; but Drink made from Corn or Fruits boil'd in Water is known to be good: As that which is made from Malt, by steeping in Water, then boiling, fermenting and fining it down, which we call Ale or Beer; neither is the reason less clear and evident from the making of Cyder from ripe Summer Fruits press'd, then fermented or work'd and afterwards fin'd, which hath been so extoll'd by the celebrated Name of Wine: from all which Preparations proceed, attenuation, dilution, lubricity, fluidity, the separation of the thin from the thick, and consequently we may naturally conclude the separation and excretion of the fluids is easier perform'd in the human Body.

Of Manducation or chewing of Victuals.

THE Food being thus chang'd as hinted before, still undergoes further Alterations in the Mouth, which are made first from biting: Secondly Mastication: Thirdly a Mixture of Air with the Mucous and Saliva: Biting requires the Opening or Abduction of the Inferior Jaw from the upper towards the Throat, directly upon the Condyliforme Process, under the prominence or rising of the temporal Bone, by the help of the Ligament and Interposition of the cartilaginous Lamella articulated thereto, as *Vesalius* hath describ'd it. And in the next place, Biting requires a strong Compression of the lower Jaw against the upper; so that by the Teeth being

being plac'd betwixt, the Food may be cut or ground.

The First Action is perform'd by the Contraction of the Biventrician Muscles, according to *Casseri*, which arising carneous from a small Trench indented or sunk into the *Basis* of the *Mastoide* Process, descending as *Vesalius* says, they make a Tendon, from whence they pass by the *Stylohyoide* Muscle and the Annular Ligament, cleaving to the side of the *Os Hyoidis*, from whence they become carneous again, and being supply'd with fleshy Fibres from the very *Os Hyoidis*; they ascend even to the very inward middle and lower part of the Chin, and are there inserted: So that by this piece of Mechanism the Strength and Direction or Tendency of these Muscles are understood, not without great Admiration at the artful Fabrick.

The latter Action which consists of bringing the Jaws together with force, is perform'd by the Contraction of the Temporal Muscles, says *Vesalius*, which being united with a large semicircular carneous Origine from the hollow of the *Os Frontis*, sinks into the Sphenoide and Temporal Bone, together with the Fibres running under the *Os Jugale*, which being strengthen'd and determined by the Fibres taken from thence; they become all about tendinous, but as yet carneous, on every side of the *Coronoide* Process of the lower Jaw; the *Masseters* which says *Vesalius* are carneous, and arise thick from the First Bone of the lower Jaw, and the Jugal Bone, here crossing their Fibres, they mutually insert themselves into the inferior, and exterior Margin or Edge of the lower Jaw, from the point or corner of the Chin, for near four Fingers breadth. The external *Pterygoides* which *Fallopini* and after him *Verheyen* remarks, that arise from the outward Part of the exterior Wing of the *Pterygoide* Process, in the *Sphenoide* Bone, and the upper Part of the same *Sphenoide* Bone, running backwards are inserted by a strong Tendon, in the
semilunar

semilunar Space, situated in the internal Part of the lower Jaw, betwixt the *Condylode* and *Coronoide* Process: The internal *Pterygoide*s, according to *Fallopious*, *Verbeyen* and *Cowper* in his Appendix to *Bidloo*, which arising carneous and tendinous from the whole inward Superficies of the external Lamella of the *Pterygoide* Process; progressively descending broad and strong, have deep Impressions made in the Tendon, a little above the internal Angle or Point of the lower Jaw under the great *Apophyses*: For if the eight Muscles describ'd act together, the lower Jaw must be squeez'd or press'd with incredible force against the upper, and the eight cutting Teeth, being thus strongly compress'd makes the Action of biting.

Hence the Meat or Food thus divided, is thrown among the *Molares* or Grinders; whose Superficies are broad, that they may perform the Action of Attrition: The straightning or holding of the Jaws strict together, proceeds first from the Contraction of the *Buccinator* or Trumpeters Muscle, which *Cowper* says, arising broad and carneous in its beginning from the Fore Part of the *Coronoide* Process of the lower Jaw, sticks with strait Fibres in the Gums of each Jaw, which going forward thro' the Cheeks is inserted in the Angle of the Lips. The *Orbicularis* of the Lips, says the same Author, which performs the opening of the Mouth and Lips with its carneous Fibres is inserted into no Bone at all. The *Zygomatic* Muscle which hath a carneous rise from the external Part of the *Os Jugalis* descending obliquely is inserted about the corner of the Lips, the common Elevator of the Lips which is inserted from the fourth Bone of the upper Jaw to the meeting of the Lips, in its own Tendon under that of the former, the proper Elevator of the upper Lip, which from the same fourth Bone hath immediately its rise upon the former obliquely descending, disappears under the

Skin

Skin of the upper Lip: The proper *Depressors* of the under Lip arising from the lower Part of the Jaw next the Chin, are inserted into the under Lip: The proper Elevator of the under Lip, which springs from the lower part of the Gum of the under Jaw, is inserted into the lowermost Part of the Skin of the Chin: Lastly, by the Help of the common *Depressor* of the Lips, which arises carneous from the lower Edge of the lower Jaw, about its sides the ascending is inserted to the corner of the Mouth or Lips.

If all these act together, then the Cheeks and Lips are so clos'd to the Gums and Teeth, that neither Meat nor Drink can fall betwixt them; but if they move successively, they are directed to different places: In the next place the same Constriction is made by the Tongue, the Muscle chiefly voluble through all, and easily moveable to every Part of the Mouth is acted: First, by the Muscles call'd *Genioglossi*, arising from the internal Part of the Chin by a carneous Beginning, issuing out by Dilatations, and inserted into the root of the Tongue, which draw the Tongue forward, and contract it back again, and as *Cowper* further shews, the *Ceratoglossi* arising from a broad carneous Beginning on the side of the Os *Hyoidis*, from whence ascending by a large Duct of Fibres, we see them dispers'd thro' the Tongue, they move it back, depress and extend it: The *Styloglossi* which arising from an external Part of the *Styloide* Process of the Temporal Bone, by an acute Beginning obliquely descending, insert themselves by the hind Part of the Tongue, which they raise, draw side ways and extend. Secondly, by the Muscles forming the very Body of the Tongue which are according to *Malpighius* Longitudinal, they render the Tongue shorter, but transversely they draw it narrower, perpendicularly they lessen its Thickness: There are others that draw the Back and Sides of the Tongue, and some angular Muscles that contract it
inward,

inward, others that depress the Back Part ridge ways, or to a point, and strait or right ones compressing the *Basis* thereof: All which singly or conjunct easily explain the determinate Motion of the Tongue in the Action, it performs in the Mouth towards Direction of the Meat and Drink either to the Grinders or the Gullet; adding thereto the Action of the Fibres on the external Muscles out of the Tongue, which move together with them. But it is plain that besides the Motion of the Jaw, backwards, forwards and sideways, that the Victuals are ground and broke to pieces, by the Muscles of the Cheeks and Lips and the Tongue, without having regard to the Teeth plac'd in the *Mandables*, to which Motion over and above there are other Changes made by the Mixture of the *Saliva* and the *Mucus* of the Palate and Jaws, together with the Intromission of Air.

The Origin, Nature and Mixture of the Saliva.

First according to the Notions of *Steno*, *Nuck*, and *Valsalva*, at the Root of the Ear in a small hollow, betwixt the Mamillary Process, the *Condylode* and the *Os Jugale*, adheres a complex conglomerate gland making a *Sinus*, whence spreading it self breadth ways, it reaches to the anterior, inferior and back Parts; this Secerns the *Saliva* by its Configuration or Make, from the Arterial Blood, and deposites it into a common Duct, which perforating the *Buccinator*, about the third upper Grinder of the Teeth pours it into the Mouth. *Wharton* saith, that there is a large internal *Maxillary* gland seated betwixt the Jaws, possessing almost the whole Length thereof, which separates the *Saliva* likewise from the same Arterial Source, throwing it into an excretory Duct that rises on the back Part of it, and makes its way forward, almost to the fore-cutting Teeth, but in the

the middle way admits of two side Branches, from which spring two others that convey this *Saliva* to the Forepart of the Tongue.

There are glands says *Bartholine*, that appear under the Tongue, for that the Palate, Gums and Lips, are perforated by little Ducts or Sluces, thro' which an Humour or Fluid much like the *Saliva*; but a great deal thinner flows. *Schneider* and *Nuck* both allow the glands of the Palate, especially the hind Part as well as those of the *Uvula* and *Tonsille* to separate a *Mucus* that mixes it self with the Aliment: But all these Fountains and Sluces are so seated, that they may emit their Liquors chiefly upon the Motion of Manducation or chewing. And *Nuck* makes it a Question, whether in Man there be any other Salivatory Gland or Duct?

The *Saliva* is a diluted Humour or Fluid, which is pellucid, will not congeal or thicken by the Fire, and is almost void of Taste and Smell; if shak'd it will hardly froth, it is a glandulous Liquor secreted from pure Arterial Blood; more copious fluid and sharp by Abstinence; but long fasting makes it very acrid, penetrating, deterging and resolving: Flowers, Meal, or succulent Vegetables encreases its Fermentation; it is thinner in Brutes, healthful Men and such as sleep much; too great a voluntary Secretion or Discharge of it, creates or procures an *Anorexia*, *Dyspnæa*, and *Atrophia* or wasting: Water and Spirits makes it abound, but Salt and Oil decreases and makes it less in Quantity.

The Motion of *Mastication* therefore by expressing the *Saliva*, and mixing it intimately with the Aliment, tends, first to promote the Nutrition of the Body. 2ly, To mix the oleous with the aqueous Parts. 3ly, For the Solution of the Saliva. 4ly, Fermentation. 5ly, An Alteration of Taste and Smell. 6ly, Exciting the intestine Motion in the mean time by the Assistance of Air, Aliment, *Saliva*,
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and *Mucus*, well mix'd and incorporated together, by the weight of Fluidity, Elasticity, Heat of Body, and variety of Pressure at all times, there is Attenuation, Production of Fluxibility, and a Continuation of intestine Motion throughout the whole Mass.

Thus being subdued and rendred tractable, attenuated, moisten'd, and lubricated the Food or Meat, is protruded towards the Gullet, whilst being bound there, by the Muscles of the Cheeks and Lips together with the Motion of the Tongue, it is compress'd betwixt this and what *Bidloo* calls the fornicated Palate, and the foldings between the Cheeks and the Oesophagus, while the *Genioglossi*, the *Dorsi Longitudinales*, the *Styloglossi* and *Ceratoglossi* by successive Motion act upon the hollow Root of the Tongue under *Cowper's Vail* of the Palate, the *Uvula* and *Almond glands* upon the *Larynx*, and *Pharynx*; and forming before the Membranes that cover them those Bodies of the *Vertebrae* of the Neck, which assist Deglutition or swallowing.

Then from the Action of the *Genioglossi*, the *Geniohyoideus* as *Casseri* mentions arising from the inward Part of the Chin, is fix'd about the Articulation of the smaller *Cornua* of the Cartilages of the *Os Hyoidis*; the *Mylohyoideus* which proceeds in a large Tendon from the middle Part of the *Basis* of the *Os Hyoidis*; is tyed or fix'd again by a large *Aponeurosis* to the lower Mandible, near the Grinders even to the Fore Parts possessing that Space which lies betwixt the *Os Hyoidis*, and the insides of the lower Jaw. The *Styloceratohyoideus* which springs from an acute carneous Beginning of the Styliforme Process of the Temporal Bone, obliquely descending forward, penetrated by the Digastrick is inserted into the Articulation of the larger *Cornua* with the *Os Hyoidis*; the Root of the Tongue is extended and lifted up, which being apply'd to the Vail of the Palate, the *Foramen* of opening

opening into the Nostrils is shut thereby; likewise the *Os Hyoidis* and the *Larynx*, assisted by the Contraction of the *Thyrobyoideus* of *Aquapendent*, which arising carneous from the side of the *Os Hyoidis*, in its descent it is tyed to the lower Part of the *Scutiforme* Cartilage, they are raised up, and by the Pressure made in swallowing they shut the *Epiglottis*, and apply or clap the *Uvula* to the Chink of the *Glottis*; expressing from the Palate, *Tonsillæ*, *Uvula*, the Root of the Tongue, *Epiglottis* and Glands thereof, a slippery Mucus, they do not only come round in Deglutition, but they move forward, at the same time the Root of the Tongue, the *Os Hyoidis* and the *Larynx*; so that they open the *Pharynx* as *Valsalva* relates, relaxing the *Oesophagus* according to *Cowper*, and so by that means perform the act of swallowing: But at the same time the internal and external *Gargarcon* Muscles as *Fallopian* and *Riolan* call them, elevate the Vail of the Palate, extend it every way governing the *Uvula*, so in swallowing they open the *Glottis* which being fallen, they occasion an Eructation, or casting up thro' the Nostrils.

From hence relaxing all that were contracted, both the *Sternohyoidei* move, which from the internal Part of the *Clavicle* near the *Sternum*, ascending with a broad carneous Beginning is inserted forward into the *Basis* of the *Os Hyoidis*; the *Coracocervicohyoidei*, which arising from a round carneous Beginning of the upper Part of the *Scapula*, to the Root of the *Coracoide* Process in its Progress making two Bellies, is affix'd to the Forepart of the *Os Hyoidis*. So the *Pharynx* being shut at the same time constringes the *Oesophagus*, arising on each side of the *Scutiforme* Cartilage, and running into each postick Line of the Gullet, by the force of swallowing they close in the hollow of the *Oesophagus*, under the *Pharynx*.

Which Tube saith *Verbeyen*, consisting of divers Membranes, depending mutually on each other,

20 *The Action of the Stomach upon the Aliment.*

which by the Assistance of the first *Mucus* constantly moistens the internal Cavity, rendring the *Saliva* more oily, whereby it affords a slippery Passage indeglutition, and gives a necessary Flexibility to its Fibres. In the next place, where it depends on the former glandulous Coat, there a Juice is express'd by the canals into the hollow of the Tube, and here the Musculous Bodies are encompass'd by the orbicular Fibres, which are bound in by the Longitudinal; and at last all the fine thinner Parts are involved in a fibrous and vasculous Membrane. Therefore by the Contraction of the longitudinal and orbicular Fibres the lubricous Deglutition is made, by the fat way being dilated in swallowing, whence the Aliment is protruded thro' the relax'd open Passage into the very Mouth of the Stomach; and therefore where it descends, the upper Flesh as *Bartholine* says of the lower Muscle of the Diaphragm, binding or constringing the Gullet there, as it passes by, shuts the Stomach or *Ventricle* in this Part.

The Action of the Stomach upon the Aliment.

THE Meat and Drink being swallowed, shut up in the Stomach, entertain'd with Heat, and mix'd with the Air, according to the variety of matter, begins in this Place naturally to ferment or putrefie, either of which ways it is wonderfully changed, into a sour, sweet, or rancid Mass.

The ragged Coat of the Stomach which receives the Aliment, is furnish'd partly with a hairy, tubulous, rough, moist, glutinous Cavity; and partly convex supply'd with many different small Glands, which arise from the vasculous Coat that adheres to it, abounding with *Arteries*, *Veins* and *Nerves*: Therefore from its small Sluices or Canals, it constantly emits

The Action of the Stomach upon the Aliment.

emits a thin, subtile, pellucid, spumous Fluid, enrich'd with Spirits, moderately salt, and in the most voracious Animals, not Alkaline nor Acid, but in long fasting acrid, which is secreted out of the small Ducts of the *Gastrick Arteries*, besides a smooth Mucus Humour from the Glands, collected in little Bags, and express'd thence into the Cavity or hollow of the Ventricle: Large Contractions of the Stomach makes great Foldings, which stops the Aliment, causing an acrid Ferment and assisting the Attrition or breaking of the Food to a Pulp, exciting thereby Hunger: *Malpighius* and *Peyerius* inform us, that such Animals as want this villous Coat and these Liquors, have a Crop or Craw, and *Sinus* or Receptacle before the Ventricle, which consists of almost the like Texture and Humours.

If we consider in what Plenty the *Saliva* continually flows upon this Part to the Food, both from the Mouth and Gullet, perpetually diluting what is upon the Stomach, agitating the various Parts, effectually giving Motion to them by the Admission of Air, and exciting Heat in the Part; by which means we shall see the Effects perform'd of Maceration and Dilution, and the Aliment so attenuated and dissolv'd that Fermentation is procur'd, and thus adapted to enter into the Passages and Humours of our Body: Yet we cannot from hence discern how the Solids, that are not yet chew'd and broken to pieces, become successfully digested in the Stomach.

But that the Cause inquired after, may be found out, let us look into the Muscular Fabrick of the Stomach, and consider what Actions depend thereon: Then it will appear that the carneous Membrane of the Stomach, according to *Willis* is compos'd on the convex Part of strong Fibres, which beginning at the upper Orifice proceed to the *Pylorus* in an orbicular or spiral Order, and surround its Cavity in a perpendicular Situation almost the

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whole Length thereof, and bind it length ways by its Contraction, but on the concave or hollow Part, it consists of Fibres, first of all oblique, which contract the bottom of the Stomach, obliquely towards its back Part, and towards the upper Orifice, and so length ways lessening the Contraction: In the next place, it hath strong Fibres, spreading over the *Pylorus*, by a Parallel Course length ways, united on the back Part, running round the upper Orifice, and so they open the Mouth of the Stomach when empty, and shut the upper Orifice when full, closely confining the lower.

It is likewise plain, that this Membrane is still girt as *Willis* observes, with another extreme one, which on the Convex Part is very vasculous, but on the Concave fibrous, with a Parallel Longitudinal Duct which helps the Constriction or binding length ways; and therefore these Fibres are very springy, but are not altogether strong enough to discharge the Stomach, where they act together, they shut the Orifices, forcibly press or squeeze the distended Contents, mix and grind them with the vermicular Motion, attenuating the gross Mass contain'd in the Stomach, driving the more fluid Parts towards the *Sinus*, before the *Pylorus*, by which being contracted but less closed than the upper Orifice, the thinnest Part which is reduced to a pulpy matter, first is by degrees leisurely thrust into the *Duodenum*.

By such a Motion only says *Harvey*, but more violent many Animals use to macerate their Food: Our hearing saith *Borellus* is witness of this, so that Observation demonstrates it effectually; but the Nervous and Muscular Fabrick of this *Viscera* informs us that there is the like in our selves.

Whether or no, or from what Cause can we understand, why little Meat and Drink received shall make the Stomach evacuate or discharge? Why the
Stomach

The Action of the Stomach upon the Aliment. 29

Stomach too much loaded shou'd not do the same or digest, but vomit up crude that which hath lain there some time? What Reason can be given that tho' we greedily and at once pour down Liquors, the Stomach shall certainly retain them.

But these Things not yet appearing sufficient to explain the Alteration of the Aliment made in the Stomach; we ought further to have regard to, or bring under our Consideration. First the perpetual nourishing Heat of the ambient Parts. 2dly, The innumerable Motions or Strokes of the Arteries that are in the Stomach, Diaphragm, Caul, Spleen, Liver, Pancreas, Mesentey and Peritonæum. 3dly, The forcible Vibrations of the *Aorta* it self. 4ly, The Strength of the Nervous Liquor in no place more plentiful than here. 5thly, The continual Reciprocal and strong Compression of almost all the *Peritonæum*, by the great *Diaphragm* as *Bartholin* and *Vesalius* both call it, which ascends from the right inferior Part of the Three First *Vertebrae* of the Loins, on the left, from the last and last but one *Vertebrae* of the *Thorax*, arising from a tendinous and then a carneous Beginning with streight Fibres on the upper Part, springing from a thin membranous Beginning, it presently grows carneous from all that side of the cartilaginous Top of the inferior Ribs and the lowest Part of the *Sternum*, running downwards with a Hundred creeping Fibres; it becomes tendinous, and is intermix'd or confounded with the former: From whence acting as from a Convex, it is plane, and binds the *Abdomen* and its Contents; strongly compressing Ten *Abdominal* Muscles with one united Contraction, and governing the *Abdomen* by its reciprocal Motions and great Strength, as Contemplation informs us.

For first saith *Vesalius*, the oblique, exterior, tendinous and carneous Part, arises from the lower side of the Ribs, descending it grows tendinous, and is

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24. *The Action of the Stomach upon the Aliment.*

inserted into the *linea alba*, the *Os Pubis*, the anterior and upper Side of the *Os Ilium*. 2dly, According to *Spigelius*, the oblique inferior carneous Part arises from the circular Course of the *Os Pubis*, growing tendinous, from the fore bending Fibres, and is inserted into the *linea alba* and the Cartilages of the Ribs. *Fallopian* saith it is pyramidal and carneous from the anterior upper Part of the *Os Pubis*, grows tendinous to the *linea alba*, and is inserted into the Navel; with *Vesalius*, it is transverse from a carneous Rife, of the transverse Processes of the *Vertebrae* of the Loins, and derives it self from the Spine of the *Os Ilium*, the Ligament of the *Os Pubis*, and the cartilaginous End of the Ribs, beneath the *Sternum*, being inserted with a broad Tendon to all the *linea alba* under the right Abdominal. . Lastly, *Spigelius* affirms the right carneous one comes from the *Xiphoid* Cartilage, the Cartilages of both lower true Ribs, the Cartilages of both the upper Bastard Ribs, consisting of five tendinous and five carneous Parts, and at last is inserted into the upper anterior Part of the *Os Pubis*.

But if we think the Force of all these Causes, conspiring together in one united Work sufficient to render the Mass in one place soft and soluble enough, we may truly see the Effects which happen to this Part, the consequences of which ought to be. First, That Moveables be mix'd with Fluids, to levigate and resolve into Fluidity to produce a cineritious or ash Colour, to press by degrees, and squeez out what is contain'd therein. 2ly, That the more tenacious remains be kept or withheld from the first Operations, and that the same Causes continuing, they undergo the same Work, and shew the same *Phænomena* at first. 3ly, That Fibres, Membranes, Cartilages, the Bones, and the hardest Parts of vegetable things be render'd juicy or liquid, and lastly, that they be expell'd the Stomach,

yet

yet cohering in Form. 4ly, That by dissolving Vegetable and Animal Food, a Humor be made Analagous to that of our own. 5ly, That there be made a speedy Restoration to the Peeble from want of Strength; whilst the subtile Fluid received by the Pipes or Canals, from the Mouth, Gullet and Stomach, opening and evacuating themselves into the Lymphaticks, is from hence sent by a short Road into the sanguineous Veins, and thence immediately by the assistance of the Arteries, distributed into all Parts of the Body.

Therefore whether the Heat alone be the Stomach's Cook? or it be the vital *Acor* or Sharpness that is in the Stomach, inspiring Life, as natural to that Ventricle? Whether Digestion be deficient without Acid? What thick, salt, acid or bitter Humor, causes such Ructations in the Breast of a healthful Man, and whence this arises? Whether it be a different or various Cause that excites Hunger, and what it is? Why the Stomach swells in Digestion; but is flaccid or lank when empty?

The Action of the Intestines or Guts upon the Aliment.

THAT it may be rightly understood what happens to the Chyle of the Stomach, and the remaining Faeces in the Guts, we will consider the Fabrick or Structure of this Duct, the Humors drawn from thence, the absorbing Vessels, their Motion, and that of the circumjacent Parts. First, The Coat or Covering of the small Guts, which contains the Chyle, is rough, broad and perforated with aqueous and glutinous Pipes, with the Mouths of the Lacteals and large Apertures, which being distinct, afford a watry, glutinous Humor, that constantly moistens and

and lubricates a musculous one lying upon it, which is very rough, here especially, where it is tyed to the *Mesentery*; and convex with a vasculous, glandulous and nervous Part; from whence 'tis a Check to the Chyle and *Fæces*, a continual Interception of these, the Lubrication and Defence of the Cavity, daily Dilution of the grosser *Fæces*, especially about the end of the *Ileum*, where there is an Oiliness of the solid Excrement.

Here is another thin Coat, according to *Willis*, except we will suppose it to be part of the same, consisting of a reticular Texture of an innumerable quantity of arterial, veinous and nervous Vessels, which adhere almost to the Basis of the *Peyerian* Glands, the tops of which opening to the Superficies, supply it with a Gelly or Mucus, these in the beginning of the small Guts are few, but increase in Size and Number; from whence proceeds Heat, Pulsation, Trituration, Dilution, Lubrication and a Defence.

A muscular Coat surrounds this, with a concave Part, strengthen'd with thick, firm, annular Fibres, inserted into the Sides or Borders of the *Mesentery* as a *Tendon*; from whence the whole Cavity of the small Guts is bound successively by Parts with rising Valves that play backwards and forwards reciprocally; the Contents are lodg'd in the rough Sides of the Intestine, where they are ground, mix'd, attenuated, and hindred from Concretion, the very sides of the Guts, being rub'd off from the Convex Part length-ways the first striking against them, with which folding in, they are contracted, and are stretch'd out-right, especially in Places from the Region of *Mesentery* to which they are tyed.

The last external Coat of all that wraps in the former, is from the Peritonæum, and knit to the *Mesentery*. This whole long Duct, Pipe or Canal, is tyed short to the Borders or Sides of the *Mesentery*; it

Of the Action of the Cystick and Hepatick Bile. 27

it hangs downwards, and is gathered or folded wonderfully into a great many Turns or Windings, almost every way, being cloth'd and interspers'd with Fat, beside the Lubrication it receives from the gentle Exhalations or Dew of the Caul; it is relaxed and render'd moveable; is extended or stretch'd under the *Peritonæum*, with which, by the Motion of other ambient Causes, they perform reciprocal Actions together: In a healthful Condition, it only wants diluting, the Fæces growing thick, or the nearer their Exclusion, in a sound and lively State this Vessel is wonderfully contracted; it is perpetually agitated by the Peristaltick Motion, wherefore it becomes more apt for grinding, bruising, separating, dissolving, attenuating and volatilizing, from whence it propels the Chyle into the Mouths of the Lacteals, and these are common to the whole Tract or Circuit of this Vessel.

In the *Duodenum* its Rectitude and Narrowness is proper to it, but it is laxer at its knitting to the *Mesaraick*, the Perforation at the end for the common Passage of the Bile and the Pancreatick Duct of *Wirsungius* otherwise joyned together, according to *Glisson* and *Graef*, are sometimes separated or divided; wherefore the celebrated Passage to the Chyle is made by these Mouths, by this way you may discover a triple Humour entring the Cavity of the Gut, to wit, the *Cystick* and *Hepatick Bile* as well as the *Lympha* from the *Pancreas*.

Of the Action of the Cystick and Hepatick Bile.

THE Bile of the Bladder is thicker, of a deeper yellow, bitterer, and which does not constantly flow into the Intestines, but is secern'd copiously by external Compression, and the Contraction of the irritated Fibres. But the *Hepatick Bile* is thinner,
more

28 *Of the Action of the Pancreatick Lympha.*

more pellucid, softer, and flows drop by drop, being only expell'd by the Actions of the Ducts and Humors about it. Thirdly, The Pancreatick Juice is almost perpetually secreting; from which when it meets with the *Saliva* and *Mucus* of the Mouth, Gullet, Stomach and Guts, it makes a spumous or frothy Liquor, and sometimes a little clammy, which is often squeez'd up into the Stomach when empty.

But the *Cystick Bile* resists, sharps and sours, and is furnish'd with another Faculty peculiar to it self; it is saponaceous, absterges and makes Oils mix with Water; it dissolves *Rosins* and the most tenacious Gums, and makes them homogeneous, is neither Alcalick nor Acid, but coagulates Oil, Salt and Spirits diluted with Water; will not burn, except it be first dry'd, and is the most biting or sharpest of all the Humors of the Body; wherefore its Effects are when mix'd with the *Chyle* and *Feces* to attenuate, absterge and stimulate the moving Fibres, to intermix those Fluids which are of different kinds, to break the acrid saline Parts, and divide the coagulated or thick ones, to expedite the way for the *Chyle*, excite or provoke the Appetite to serve instead of a ferment, and to assimilate the crude to the Parts digested, in these the *Cystick Bile* much exceeds the Hepatick, the Description of which I shall refer to the *Liver*.

Of the Action of the Pancreatick Lympha.

UNder the hind Part, and the bottom of the Stomach, in the first Place there hangs in the posterior Lamella of the *Caul*, a large conglomerate Gland, call'd by *Wharton*, *Graef* and *Vesalius*, the *Pancreas*, which by the Assistance of the *Cæliack Arteries* and the Texture of the Gland secrens a Humor
or

or Fluid into one common Duct, which makes its Exit into the *Duodenum*, and from thence brings all that *Lympha*; but it is almost insipid, in Taste somewhat salt, limpid, plentiful, always making and emitting, neither *acid* nor *alkaline*, but analogous to the *Saliva*, confusedly mix'd with the *Bile* in living Bodies, being digested therewith, and adhering in the same *Pipe* or *Tube* with it, is not observ'd to give any Assistance to the Motion of the Gut, but is equally distributed thro' it, and sometimes flows alone into the Empty Intestines, hence the Use of it is to mix with the *Chyle*, *Fæces*, *Gall* and *Mucus*, in order to dilute their grosser Parts and render them more fluid and thin, that they may better mix together, to render the *Chyle* more miscible in the Blood, and to adapt it for a readier Passage thro' the *Lacteals*, to soften its Austerity, Viscidity and Bitterness, to change its Colour, and intermix it perfectly with the *Chyle*, to make it capable of performing the Office of a *Menstruum* and *Vehicle*, so to change the singular Taste and Smell of Food, that it becomes as it were almost indolent, and that the *Chyle* may be able to go and return this way with Ease and Expedition.

Wherefore being strongly question'd wilt thou answer, whether the *Bile* be double? Whether an Excrement of the *Hepatick Chyle*, while the Blood is there return'd back? or whether it produces any Advantage to Health and Life? but what is that? in short whether the *Pancreas* and *Bile* answer the System of *Helmont* and *Sylvius*? or whether they become a *Duumvirate* here and what? whether they can excite and sustain Life from the Intestine Motion of the Blood? what the *Pancreatick Juice* is, and to what end? why does it flow with the *Bile*, or at least next it? whether the Animal can live well without it?

The Propulsion of the Chyle into the Lacteals.

BY the Contraction of the strait Fibres of the *Intestines*, which are inserted to their external Coat as a Tendon, the Vessel or Pipe is made rough in the Part which is turn'd back from the *Mesentery*, hence from the spiral Tube it acquires a *Cylindrick* Figure, by which means in the Part joyn'd to the *Mesentery* it is lax, in the Part against the *Mesentery* it is constring'd; wherefore the Passages or Pores next the *Mesentery*, that is, the Mouths of the *Lacteals*, are found lax and open to the Fluid, moveable and lubricated Chyle, by which it may readily enter; in the mean time the Valves being strengthen'd by the same Force erect, mutually approach each other, intercept the *Chyle*, stop it, and almost close the contracted Part of the Intestine.

Also by the orbicular contracted Fibres, inserted into the *Mesentery* as a Tendon, the *Cylindrick* Spaces are contracted, and shut up by the Valves mutually pressing to each other, wherefore the *Chyle* by means of this Force, and the Action of the ambient Bodies, is squeez'd out, diluted, mix'd and driven towards the proper Places in the *Mesentery*, that is, it is forced into the Mouths of the *Lacteals*, which are best open'd by the *Peristaltick* Motion: Yet the fermenting *Chyle* enters not the *Lacteals* by its own Energy. That *Chyle* therefore that enters the Mouths of the *Lacteals*, is falsely suppos'd to be only the Production of Meat and Drink, for it is a Fluid or Humour consisting chiefly of *Saliva*, the thin Mucus of the Mouth, that double Liquor of the Gullet and Stomach, of the *Cystick* and *Hepatick Bile* the *Pancreatick Lympha*, of *Peyerius* intestinal Humor, and as *Brunnerus* of the *Pancreas* says, of that strong, copious and subtle Liquor, supply'd from an innumerable quantity of Nerves; for all these Humors, whether

The Propulsion of the Chyle into the Lacteals. 31

whether passing thro', flowing out, or mix'd with the *Chyle*, are always entering the *Lacteals*, tho' they are only conspicuous or visible a little after eating.

Whether or no the thin, bilious and lymphatick Part of that *Chyle* is not more received into the absorbing Vessels, that open upon the inward Superficies of the Guts, and empty or discharge themselves into the *Meseraick Veins*, from whence there is a Dilution made in the *Vena Porta*, and new Matter for the *Bile* to secern? Certainly the Number of these, their Largeness, and singular Texture or Make about the Intestines, their common Nature with all Veins, the Humor flowing hence, as well into the *Vena Porta* as the *Artery*: The Disposition of this Fluid; the great quantity of Humors meeting in the Intestines, which are not all received by the *Lacteals*, neither are they observ'd to be expell'd by Siege. Comparative Anatomy not finding *Lacteals* in *Oviparous Animals*, and yet discovering a Passage in the *Meseraicks* from the Cavity of the Intestines, this Enquiry is answer'd.

Since all the *Phænomena* seem to depend on Meat and Drink, from the first Reception of them, to their Entrance into the *Lacteals*, their Consequences seem clearly, naturally, and distinctly demonstrable from the Structure, Fabrick and Strength of the Vessels, the natural Knowledge of the Humors, and their virtual Operation demonstrable to Sense or reasonable Mechanicks; whether these ought to be call'd *Postulata*, that are obscure, doubtful and dissonant to Reason and Experiments? Heat is call'd the Cook of the Stomach, its native Life, and what renders the Sourness thereof volatile. The *Archæus*, the Smith, the Alcaline *Bile*, fermenting changes the fix'd acid *Chyle* into a volatile salt one, the Sharpness of the *Pancreatick Lympha*, and the Effervescence with the *Alcaline Bile*, the Precipitation that depurates or fines down the *Chyle*: Peripate-
tick,

sick, Galenick, and Chymick Faculties; with a thousand other pernicious *Hypotheses* and false Notions that give Laws and Rules to Physick.

The Matter and Expulsion of the Intestinal Fæces.

THE grosser part of the Aliment received, sticking obstinately in the Mouths or Orifices of the *Lacteals*, is loosed as it were by the Force of *Manducation*, the liquid Part being absorb'd, by the continual Gyration or Motion of the small Guts and the Structure of the Valves therein, driving the Solid by degrees into narrower and straiter Places, the lubricated Fat of the Glands giving way, it becomes press'd, squeez'd, macerated, and drawn dry from any more Juice, 'til at last it is successively thrust forward into the wide Gut, call'd *Cæcum*.

The *Diverticulum* or Turning aside of the *Cæcum* as *Vesalius* will have it, the vermicular Intestine, the Valve of *Tulpius*, from hence make a perpendicular Ascent in the first Colon, that it cannot return into the *Ileum*, but stagnating here, the *Fæces* being strongly press'd from their own Weight, the Action of the Gut and the external Parts about it; they are deprived of all Moisture which is absorb'd into the Lymphaticks: Hence they discharge or empty their Humors into the *alveum lacteum*, then the *Fæces* grow hard and dry, and putrifying at last, gain a foetid Stench, and become Excrement or Dung: Then the *Valves* which are here so common, says *Bartbolin*, and made of muscular contracting Ligaments, by their bending or winding in, shew where the Stoppage is made, that the *Fæces* are retain'd so long; from hence the strong, membranous muscular Fibres, by the Strength of their Contraction, make

make the *Faeces* hard and immoveable, so that they would not be easily driven thro' the long Canal of the Guts, but as they are lubricated by the Fat of the Glands, as *Peyerius* asserts, and thereby sent into the *Intestinum Rectum*.

The almost perpendicular Descent of which, says *Vesalius*, the internal Superficies whereof being smooth or lubricated without Valves or any Muscular Ligament, makes that being driven thus far, the *Faeces* readily descend by their weight or acrimony, or both, irritating the strong Muscular Fibres, compressing the Gut, till the *Faeces* stick at the *Sphincter*. Then relaxing the large, gross, carneous, orbicular *Sphincter* as *Bidloo* calls it, that surrounds the end of the *Intestinum rectum*, the *Levators* of the *Anus* are contracted, which from the internal Part of the Bones of the *Pubis*, *Iscium* and *Sacrum*, which striking the End of the *Rectum* with their winding Fibres, they dilate and raise it up. Hence by inspiring, Retension, Rarefaction, Compression of the Breast, the Assistance of Air, and then of the Diaphragm and *abdominal Muscles*, the *Faeces* are expelled, while the *Sphincter* is only contracted.

From whence it appears what the matter of the *Faeces* is: Whether it consists of the Recrement of the *Bile*, *Blood*, *Mucus*, *Saliva* or *Lympha*: What its particular Cause is: Whether from an excrementitious Ferment: Why the Intestines from thence have more Glands and more Mucus: proper to their purpose: What Use Fat is of to the Guts, chiefly at the end: Why strong People are costive, have hard Stools and few of them: Why the *Hemorrhoides* are so common to such: Why in Exoneration, *Urine* is discharg'd together with *Siege*: Why the *Tenesmus* attend such as labour under the Stone in the Bladder? Why the *Strangury*, in the *Bloody Flux*, and why the *Tenesmus* in the *Strangury*.

The Action of the Mesentery upon the Chyle.

That Chyle which is impell'd by the *Peristaltick* Motion the Mouths of the *Lacteals* being open, is propell'd the same way, and by the same assistance; but when the *Lacteals* are open'd into the Cavity of the Intestines by an oblique way, as many affirm, and the Mouths are small, the fluid Part only, separated from the grosser and more ramous, will enter. Whence we may conceive, why Men are not hurt with that variety of acrid, hard and sharp things which they eat, but remain healthful notwithstanding; let us compare the Structure of the *Oesophagus*, the Stomach and Guts, and we shall see they differ widely from the Structure of the rest of the *Viscera*.

The Causes which derive the Chyle into the *Lacteals* remaining, they are impell'd again a-fresh, and so promote the former, that it may flow by the Vessels situated betwixt the Duplicature of the *Meseraicks*, it is coerced by the semilunar Valves of *Nuck*, and the Flux carried towards the Loins. The *Lacteals* arise from the smallest Beginnings in the human *Mesentery*; most of the lesser concurring at acute Angles, create a larger Stream, then again recede mutually from each other, and after that making an Island unite in one Canal, which is divided as the rest, that hence they may form larger Trunks, which are every where supply'd with many Valves, hence the Mixture, Fluidity and Attenuation is increas'd: So far they are call'd *Lacteals* of the first kind.

The

The Action of the Meseraick Glands.

Hence in a right, oblique, cross or divided way, they tend to *Nucks Glandulae vagæ*, interspers'd thro' the *Mesentery*, running from whence, they enter, clothe, and surround or bind them in, but going out again, they are less branch'd, being turgid with the more fluid and aqueous *Chyle*, and distinguish'd by many Valves, and then they run to the *Cistern* seated on the Loins, and these obtain the Name of *Lacteals* of the second kind. From this it is evident, that the *Chyle* cannot be any ways discern'd, at these Glands, but seems to be there temper'd or allay'd; which is the more apparent, if we suppose with *Nuck*, that these cavernous Glands are water'd from many *Arteries* and *Nerves*, and that they admit the *Lympha* of the several *Viscera* in the *Abdomen*, which entring there, dilute the Humors the more: Therefore being stop't upon that part, there is made a Conquassation, Dilution, and perhaps a Mixture of the Spirits from the *Nerves*; from whence the *Lacteal Vessels* being more united, tend to *Nucks* Cistern of the *Chyle*, often to that, call'd by *Cowper* Trilocular, and hereby the most copious *Lympha*, saith *Nuck*, evacuates it self of almost all the Parts, seated under the *Diaphragm*, from whence being brought by the *Lymphaticks*, it is thrown into this common Channel: For the Valves, Ligatures and *Lymphatick* Diseases instruct us, that there is such a Course or Circuit of this Fluid, which abounding with water Spirits and subtile Salt, is the most pure Part of the Blood, as its Office, excretory Ducts, and sensible Functions demonstrate.

The Action of the Chyliferous Duct upon the Chyle.

THE *Chyle* being thus diluted by the Cisterns plac'd under the *Diaphragm*, from the Causes already describ'd, chiefly by the Force of the *Septum Medium*, and the Pulse of the descending Trunk of the *Aorta*, it is thrown into *Pequet's Thoracick Duct*, furnish'd on all sides with Valves, from hence into the left *Subclavian* just thereabouts, where the *Jugular* opens into it, bound or directed by the help and assistance of the *semilunar Valve* of *Lower*, scarcely admitting the *Chyle* into the Vein, but none at all into the *Thoracick Duct*; the whole *Lympha* flows together almost from every part of the *Thorax*, whence it comes that that great plenty of *Chyle* and *Lympha* ascends so easily in Man who is erect, by so small or slender a Pipe, that is convey'd with Winding or Turnings, which will more plainly appear if we consider. First, The contractile Spring or Strength of the *Intestines*, and the assisting Force that drives the *Chyle* from them. 2ly, The Aptness of the *Lacteal Valves*, the Cistern and *Pequet's Duct*, that expedites the Motion with wonderful Efficacy. 3ly, The Pulse of the *Meseraick Arteries* which strike the *Lacteals* in Parallels. 4ly, the great Strength of the *Diaphragm* upon the Channel. 5ly, the Pressure of the *Peritonæum*, which from powerful Causes acts upon the thin *Meseraick Membrane*. 6ly, The proper contractile Form of the Sides of the Vessels, that compose *Pequet's Duct*, which is very strong even after Death. 7ly, The strong Pulsations of the *Aorta* it self, so near to the *Thoracick Duct*.

We must therefore observe those things which happen to the *Chyle* in the middle way betwixt the *Intestines* and the Veins; which we shall divide into Four. First, The slow Motion by the *Intestines*, *Lacteals*

Heals and Glands, which the Largeness and Length of the first, the Number and Smallness of the latter evince: The End of all these is refining or purifying the Fluids. 2ly, The external Motion impress'd upon the Fluid from the Vessels, the Effect of which is Propulsion, Mixtion, Attenuation and Conservation of the Fluid. Hence we are taught to contemplate the Position of the Lacteal Vessels, increasing by degrees, and supply'd every where with Valves, mutually agreeing with each other, that is going backwards and forwards, and at last uniting: In the next place, the strong Action of the *Septum*, on the Abdominal Muscles, and the Compression of the *Viscera* into the Lacteal Tubes, cleaving almost to the *Superficies* of the *Mesentery*, and lying as it were naked or expos'd; supplying a proper Heat in degree and moisture; the effects of which are known and observ'd by the Chymists: Lastly, The Pulsation of the *Mesenterick* Arteries, and the *Aorta*, being strongly united on all sides to the Canals, so that by their own motion they agitate them.

Thirdly, To make an Allay or Temperament, by the Mixture of almost all the *Lympha* of the Body, the Reception of a Chyliferous humid Vapour, that is in the first place suck'd in to these Lymphatick Vessels; and perhaps by the Admission of Spirits every-where to the conglobate Glands of the *Lympha* thro' the Nerves, and with that thrown into the *Chyle*.

Fourthly, To its Analogy with all the Parts of the Body, before it enters into the Blood Vessels; whilst it passes from the Mouth to the *Subclavian*, there is perpetually, gently, successively, and by degrees added something of almost every Humor of the Body that is elaborated, digested, frequently carried round and transacted throughout all the Vessels, as the *Saliva*, *Mucus*, *Lympha* and the *Mucus* of Gullet, Stomach and Intestines, the *Pancreatick Saliva*,

liva, the Cystick and Hepatick Bile, and perhaps that of the Spirits from some of the minutest Parts of the Body; then at last this is accurately mix'd by the Strength of the whole Fabrick, the Figure, Situation and Motion of the Vessels.

Whosoever weighs these things will find the Principles of which the Blood is compos'd, to be lodg'd in the *Chyle*, while he may perceive Water, Spirit, Oil and Salts mix'd together; neither let any one wonder at the reason why Diseases are so rare in the *Mesentery*, tho' that be seated so near to the Crude or undigested Fluid? For he may observe on all sides Provision solicitously bestow'd: The Lacteals and the Thoracick Duct are equally assisted for conveying the *Lympha* by the Spirits, as well as they serve for the Motion of the *Chyle*; but he that would know the Circuit and Change or Alteration of the *Chyle* cast into the Veins, and how it is mix'd with the Blood, must necessarily enquire into, and find out the progressive Motion and Efficacy of that Fluid, which we shall pursue in this following Method.

Of the Fabrick or Structure of the Veins and Arteries.

THE red Humor found almost every where throughout a living Body, and call'd Blood, is lodg'd in a sound Man in proper Vessels, which are either Veins, Arteries or other intermediate Receptacles. *Arteries* appear to be Canals, of a Conoide or Pine-apple-like, oblique, crooked, or branching Figure; internally they are smooth and without Valves, except in the Heart, their Branches have various Originals, but often they proceed from acute Angles towards the top, but rarely from right ones,

ones, as in the *Intercostals*, &c. seldomer from obtuse Angles as in the umbilical Arteries of the *Fetus*. They are made up of five *Tunicks* or *Coats*, the uppermost of which according to *Willis* is thin and nervous in the outward Superficies; in the inward very dense, being interwov'n with a Network Texture of Arterial Vessels from the Coronary Arteries and others, together with veins; the Second Coat, saith *Ruyfch* is cellulous, thin, but very dilatible, from the blowing up of the Cells; the third is glandulous, the fourth Muscular, being made with annular thin Fibres, strongly knit together, with a great Number of Strata, that are divisible into many *Lamellæ* and very Elastick. Lastly, The fifth Coat, which is the innermost, is thin and membranous, the Fibres being stretch'd length-ways, this intire Vessel continues to beat and leap while Life remains.

The *Veins* are in Figure and Distribution almost like the *Arteries*; but they are wider, and abundantly more in number, they are much thinner and unactive in all their Membranes; they have *Valves*, which are almost single at the Places of inserting their Branches into the great Trunk, and double chiefly says *Aquapendent*, as they join into the right Trunks of the larger Veins, that are remoter from the Heart, and which carry the Blood perpendicularly upwards; which being made so, saith *Cowper*, and apply'd to the Cavities of the Canals, that they admit the Blood from the lesser Branch to the greater, prevent its return, and sustain the weight; but these very Vessels in the greatest Actions of Life neither leap nor beat.

All the *Arteries* contain'd in the whole Body, are united to the Trunk of the *Aorta* in its Passage, while that Trunk takes its Rise from the left *Ventricle* of the Heart, but those which serve for the use of the Lungs, are in like manner stretch'd out from the Pulmonary Artery to the Right *Ventricle* of the Heart,

40 *Of the Circulation of the Blood.*

as the Form thereof shews when they are distended by an Injection of Wax.

The Veins how numerous soever, by the same Parity of Reason terminate in the *Vena Cava*, where that Vessel grows larger, and becomes cover'd with an Arterial Membrane forming a large *Sinus*, after which it presently ends in the Right *Auricle* of the Heart; But the said Vein, by the form or make of the Lungs, from the four greater Branches distributed therein, makes such a *Sinus* as the former, which is stretch'd forth into the left *Ear*; but there is some Diversity in the *Liver*, that is to be explain'd when we come to speak of that Part. Both these Vessels are largest in the Heart, from whence they decrease by degrees, and attending one another almost every where, they are extended together thro' all Parts of the Body.

Of the Circulation of the Blood.

THE Blood of a living Animal sufficient for Life, is almost totally driven out of any of the *Arteries*, open'd or divided by a large Wound, and that in a short time, and with great force, as the Butchers teach us; neither is it material, in what Artery the Wound is made, if we give credit to the Dissection of Dogs. Wherefore in a live Animal thus wounded, all the Blood is mov'd swiftly and with violence, especially if the other Arteries that are not wounded be tyed, while the Blood leaps out of the wounded Part.

From whence it is plain, there is a Passage for the Blood from every Part of the Body that abounds therewith, into every Artery; and then the whole Mass of Blood is mov'd, through that one Vessel or Canal, and consequently it ought first of all to be
mov'd

mov'd thro' the Vessels, before the Wound was given.

Again, whatsoever Part of the *Arteries* you shall see bound about with a Fillet, that will rumise and vibrate betwixt the Bandage and the Heart; likewise the neighbouring or adjacent *Arteries* that are free, beat vehemently; and if it be cut betwixt the Heart and the Bandage, it throws out the Blood quickly by Spouts or Streams, even till sudden Death succeed: But where it is cut betwixt the Bandage and the extream Parts, a little Blood only falls out by Drops: Yet we ought to take care, that it be a single Artery, not joyn'd intermediately by some large *Anastomoses* of a neighbouring Artery in the Place above the Ligature.

Therefore the Vital Blood flows by the *Arteries*, but it is from the Flux passing out of the Heart to the extream Parts, from a broader Vessel into a straiter or narrower Part, from the Trunk into the Branches; therefore by this Rule or Law of Motion, all the Blood may be convey'd into every Artery or any single one, and from that spread abroad or thrown out, and not the contrary way. Also take a large Vein and bind it with a Fillet, and it will swell betwixt the Extremities and the Bandage, but not pulse or beat: It is empty betwixt the Heart and the Fillet, and by wounding it below, the Blood will flow out, till Death or a fainting of the Spirits ensues; but if you strike above the Ligature, scarce any Blood will issue thence, nor matters it which *Vein* it is, as Blood letting shows.

Wherefore the vital Humour flows indeed swiftly from every Part of the Body into this *Vein*; but observe, after that manner, that the Road or Course is evident by this, from the extreme or remote Parts of the Body to the Heart, from the narrowness of the *Vein* towards its Enlargement, from the Branches into the Trunk, and not otherwise as the Valves instruct

struct us. Hence it plainly appears, that all the Arteries of the Body constantly carry the Vital Blood swiftly round from the left Auricle of the Heart, thro' the Trunks of the Arteries into the Branches; from these, to all the Parts of the Body, internal and external.

But on the contrary, all the Veins of the Body, except those call'd the *Portæ* in the *Liver*, from their smaller or minuter Branches, constantly carry back the Blood into the Branches of the Veins, from these into the Trunks, from thence into the *Venal Sinus*, and at last into the right Auricle; for from the *Venal Sinus* the collected Blood may be driven by the round wov'n Muscle, into the reflected right Auricle, if nothing oppose, but it receives Assistance from the Motion of the venous Blood press'd thus far.

But since the right *Auricle* as well as the left, according to *Lower*, is a large hollow Muscle, compos'd of a double Series of firm strong Fibres, running with a contrary Course into the opposite Tendons of the Sides, and endowed as *Ruyssch* saith, with innumerable Veins and Arteries, supported on one Part, from the venous Tendon of the right Side of the Heart, growing on the other Part harder, being almost form'd round, or into a Circle by the *Vena Cava*: It is plain the Blood by this contractile Strength express'd with great force, may be thrown inwards to the right relaxed *Ventricle* of the Heart.

For then the Heart emptying from a longer Return drawing back towards the Sides and towards the Point, with three *Tricuspid Valves* as *Vieussens* calls them, by the oblong fine carneous *Papillæ* or Teats, arising from the Sides of the Right *Ventricle* of the Heart at that time drawn back, yet gives sufficient way, that the Course of the Blood may not be altogether obstructed. The Fabrick of the Part, the

the *Phænomena* on live Dissections, Wind, Injections, &c. confirm the same.

But if the Right Cavity thus fill'd with Blood, by the Contraction of its Fibres presses the Blood towards the Mouth, here rising near the Sides; it elevates the *Tricuspid Valves* so tyed to the fleshy Columns, stretch'd out from the opposite Side, that being entirely fallen or flagg'd, they can never be apply'd to the Sides of the Right Ventricle of the Heart, but thrusts these towards the Right Auricle so long, till being joyn'd there, they nicely shut the Mouth perfectly hindring any Return; because those very Columns are scarcely permitted to be pull'd farther backwards.

By the same Assistance, the same Blood is forced from the inferior Parts upwards, into *Vieussens* three *Semilunar Valves*, seated in the Course of the other Passage lying open into the *Pulmonary Artery*, it presses these on the Sides of the Artery opening away, into that alone. But the Figure, Substance, and Connexion of the same Valves, demonstrate that these are thus forced from the Pressure of the Blood behind, out of the *Pulmonary Artery* to the Right Ventricle, that being joyn'd together they nicely intercept the Course, and more exactly sustain the Blood, by how much greater Strength it is push'd on: The Texture of the Part, the *Phænomena* in opening of live Bodies, *Arteriotomy* and Injection confirm it.

Therefore the venous Blood, that is, all the Blood of the Body is moved out of the *Venal Sinus* through the Auricle, and through the Right Ventricle, constantly, quickly, and violently into the *Pulmonary Artery* only. Out of the left *Venal Sinus* of *Ruyseh* from the four great Vessels running together, all the Pulmonick Blood may be taken and pass'd through, by the Musculous Strength of its Texture into the left laxated Auricle, much less than the Right yet
made

made and seated like the former : So from hence it may be easily propell'd into the left *Ventricle* for the same reason, because of the like Condition of two *Mitral Valves*, as *Vesalins Lower* and *Vienssens* call them ; but cannot return the same way.

And by reason of the three *Semilunar Valves* seated in the Entrance into the *Aorta*, this Course is directed right into the *Aorta* from the same Causes, especially if that rests, and exactly shuts up the way to the Blood forcing back again : But we speak this of an adult Man, and the usual Course of conveying the Spirits to Mortals.

Therefore all the Pulmonick Blood is mov'd from the Lungs into the left *venal Sinus*, the left *Auricle* and *Ventricle*, from hence it is constantly, suddenly, and violently thrown into the *Aorta* ; which Motion evidently appears to be done in living Creatures with these *Phænomena*.

First, That both the *Venal Sinus's* being fill'd together, swell. 2dly, That both the *Auricles* flag together. 3dly, They are then fill'd in the very moment with Blood acted or driven on, by the contractile force of the *Musculous Sinus* next that of the *Venous*. 4ly, In that very nick of time, both *Ventricles* contract themselves, they evacuate the Blood, the two great *Arteries* are fill'd and diluted. 5ly, The Moment after this Constriction each *Ventricle* flags and is empty, then is elongated, and augmented in Size. 6ly, During which each *Auricle* contracts it self by the Muscular Motion, expressees the Blood contain'd therein, and propells it into the Cavities of the Heart. 7ly, In the mean time the *Venal Sinusses* are fill'd again as in the first *Phænomenon*, and all return with the same *Series* of Order, and so remain till the Animal languishes, and is at the point of Death. 8ly, When the *Auricles* beat often as well as the *Venal Sinus's*, then the *Ventricles* are contracted after the same manner.

There-

Therefore the whole Mass of Blood returning from every internal as well external Part of the Body, and from the Heart it self, and its *Auricles* is driven into the right Cavity, from thence it is work'd by the Lungs into the left, and hence thro' the whole Habit or Circuit of the Body, and then back again to the Heart; this is the Reason of the Blood's running round, or its Circulation, the glory of which Invention makes the Name of *Harvey* Immortal; and this is confirm'd by Infusion, Transfusion, and Microscopical Observation.

In like manner the *Chyle*, tho' in small Quantity being constantly press'd thro' the Thoracick Duct, raises the *Valve* of the *Subclavian Vein*, always shut by the determinate Motion of the Blood so far, that that Portion of the *Chyle* which in its Ascent might lessen the Resistance of the Bloods Pressure, enters into that Vein, and thence passes into the *Vena Cava*, the *Venous Sinus*, the right *Auricle*, and last of all into the first *Ventricle* of the Heart.

This continual but small Admission, this concurrence or meeting of the Blood from opposite Strokes as *Verbeyen* says, by a contrary swift Motion, perform'd in this one Place, the *Lympha* returning with larger Recruits, makes it that the Mixture of *Blood* and *Chyle* is begun here, that all Concretion may be hindred or prevented.

Which being done, the *Pulse* according to the Texture of the *Auricle*, and immediately from the strong Contraction thereof, together with the opposite Concussions or Strokes of all the Columns on every side, is manag'd and divided, the Fluid preserved, it affects the *Auricle* with greater force, perhaps on the other side, as *Verbeyen* takes notice, by the Bloods glancing thro', all which are assisted and encreas'd by the Blood flowing into *Vieussens* new invented hollow of the *Auricle*, returning from the Substance of the Heart and the *Auricle*, which without

out doubt is the most agile or moveable, and is projected or thrown out with vast force in the *Auricles*.

But what is done to the *Blood* and *Chyle* thus poured into the Heart, is best known from the Property of the Blood and the Texture of the Heart; the way of discovering of which is to be taken from the variety of the Parts examined by solid Experiments, such as we shall here recite.

The *Blood* that is in the Right Ventricle of a live empty Animal, doth neither taste *Alkali* nor *Acid*, but Salt like *Sal Armoniac* or *Sea Salt*.

If it is mixed with *Acids* or *Alcalies*, it shews no evident Motions of Effervescence, but changes Colours and Degrees of Fluidity.

Leaping out of the *Pulmonary Artery* cut, and received in a Vessel, it gives us no Sign of an intestine Ebullition or Effervescence, but yields a stinking, ungrateful, acrid Fume, cooling it grows thick, and then one Part coagulates into a solid Mass, and the other becomes more fluid than before.

The *Cone* of a live Heart being cut off, and the Point erected upward, the Blood will appear to be driven or propell'd from the *Auricle* contracted in the hollow of the Heart, but neither to boil or grow hot; this is first to be view'd about the time of Death: These *Phænomena* hold true in the Blood of the left Ventricle.

Neither does a *Thermoscope* let into a live Heart inform us, that there is greater Heat in the Blood there, than elsewhere.

The *Chyle* in the *Thoracick Duct* tastes more of the Sea Saltiness, or else it retains that Taste as predominant in the Food.

The same taken out, and mix'd with contrary Salts seldom or never makes an *Ebullition*.

Received in a Vessel alone, it neither grows hot,
nor

nor ferments at all ; neither does that appear in it, while it is contain'd in the *Thoracick Duct*.

Nay, tho' collected together there, and thence push'd into the *Subclavian*; and there mix'd with the *Blood*, it neither grows hot, nor ferments, no not in the *Vein* or the *Auricle*, or the *Ventricle* of the *Heart*.

But from these Facts together with tying the *Axillary Veins* betwixt the *Cava* and the *Valve*, we cannot perceive the least Effervescence.

At length, since the *Lympha* of the Conglobate glands is now mix'd with the *Chyle*, and that is the very Issue or Production of the *Arterial Blood*, the Nature of it is to be taken from the Nature or Disposition of the same *Blood*, as to this Business, which is known also from the same Experiments.

Therefore there is no Ebullition, Effervescence or Fermentation in the *Heart*, whether you regard that, or the Liquors that flow into it ; nor are we to hope for, or expect any thing of moment from thence.

Likewise the Heat of the *Heart* will not change the Disposition or Motion of the *Blood*, as a new Cause neither will it drive it from the *Heart*.

For there is no Ferment in the *Heart* ; therefore the Cause that drives or forces the *Blood* from the *Heart* into the *Arteries*, from the *Veins* into the *Heart*, is not seated in the Mass of *Blood*, but is to be sought for, in that which contains the *Blood*, which is the *Heart* it self, therefore that such Discoveries may be demonstrated, we are accurately to weigh and consider the Cohesion, Texture, Motion and Strength of the *Heart*.

The Fabrick, Strength and Action of the Heart.

THE Heart hanging free in the *Pericardium* by four large Blood Vessels, moisten'd with a slippery *Lympha*, resting on the *Septum transversum*, betwixt the Cavity of the *Mediaſtinum* in the Breast, not too much press'd with any thing about it, but being tyed to the soft Lungs is fitted for the most commodious Reception and Expulsion of the Blood into all Parts: It has two *Arteries* arising from the *Aorta* a little above the Semilunar Valves of the left Side, by an opposite course, composing one Canal joyn'd to the *Basis* of the Heart in its whole Circuit, from whence sending out *Arteries*, they unite among themselves by various *Anastomoses*, being distributed into innumerable small Vessels; they sensibly pervade every minute Part of the Heart, and together with the Veins compose or make up the whole Substance thereof: These *Arteries* are in *Diastole*, while the rest of the *Arteries* of the Body constitute a *Systole*: But the Veins send their Blood, partly into the *Coronaries*, and from thence towards the right *Auricle* betwixt that and the right *Ventricle*, partly within the right *Auricle* and the right *Ventricle* by particular Veins, agreeable to the new Opinions of *Vieussens*, *Ruyſch* and *Verheyen*; these Veins are emptied, while the rest of the Veins of the Body are fill'd.

The Heart hath besides these Vessels *Fibres*, arising from four orbicular Tendons says *Lower*, that encompass the four Passages or Entrances into the Heart, and a great Part besides that are inserted in them, for there springs from hence. 1st, Small slender *Fibres*, in the right Road from the *Basis* to the *Cone*, posited thro' the outward Parts only of the right Cavity; with which the Flesh of the Right *Ventricle* is shut in the *Systole*, and assisted in expelling the

Blood

Blood. 2ly, Subject to these in the right *Ventricle* from the left side of the Heart, ascending obliquely to the right, and terminating in the *Basis*, they resemble a Cockle shell in their Passage. 3ly, Others again lying under these, spreading broad from the right side of the Heart into the left, embrace both *Ventricles* in their Circuit, rising up to the *Basis* of the left side, they make an opposite *Helix* with the former Series of Fibres. These are common to either *Ventricle*, being equally carry'd round them; they constrict both *Ventricles* with opposite forcible Contractions, perform'd at the same time, likewise compressing them against the *Septum medium*, they draw together the Point or Cone to the *Basis*, equally moving on all sides the Heart, with the Contraction of the Fibres. In which Action, they are assisted by another Series of Fibres, which resting upon the former by a various turning, and placed around they coerce and bind 'em in their proper Place. But the left *Ventricle* has still two hard Series of Fibres proper to it, the outward of which, however Subject to the former, arising up throughout the whole Course of the left, spirally towards the right, and partly constituting the *Septum*, ends in the *Basis* of the left, this intirely furrounds the Cavity, and hath again the like proper to it self. Lastly, There are others that are subordinate to this Series, which descending from the left *Basis* towards the right, with an oblique turning or winding, make up the interior Parts of the *Ventricle*, and loosing the *Septum medium*, carry Fibres, that are visible in their variety of Length, Flexure and Intortion. Besides these there are carneous Columns, Holes in the Walls or Partitions of the left, which is the Reason that that *Ventricle* can be closely and strongly drawn together by a common and proper Contraction; while the other Fibres and little Pillars seated in the Hollow or Cavity of either *Ventricle*, by resisting or thrusting forward in

50 *The Fabrick, Strength and Action of the Heart.*

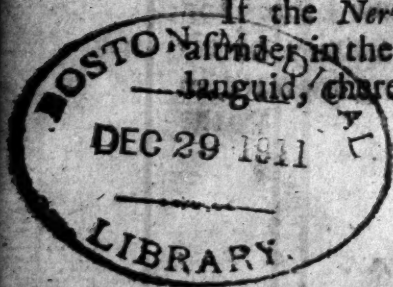
the *Systole*, and drawing back in the *Diastole*, serve instead of, or supply the Want of *Valves*.

These *Fibres*, arising from the *Nerves* of the eight Pair entering plentifully, within the *Aorta* and *Pulmonary Artery*, hence being inserted into the *Auricles* and the *Heart*, by their Muscular force, they occasion the forming of the Cavity of the *Heart*, accurately or nicely constringing it without destroying its Texture, by a proper and forcible Action. Hence it is evident, that the left *Ventricle* is mov'd or acted by a proper orbicular Contraction, the right a semi-orbicular, and that common to the left, as Inspection into the *Heart* teaches us.

Therefore the *Heart* and its *Auricles*, are true Muscles, and are acted by Muscular Strength: Whilst all the *Fibres* being made shorter at the same time, lessen the length of the *Heart*, enlarge its breadth, exactly contract or draw together the Capacity of the *Ventricles*, dilate the tendinous Mouths of the Arterious Passages, determine them to shut and express the contained Liquids with great force, thro' their dilated Mouths into the *Arteries*. This is the *Systole* or violent Motion of the *Heart*.

Moreover to shew how the Blood is expell'd and thrown out by this Muscular Contraction, the leaping of it out upon cutting the *Pulmonary Artery*, or *Aorta* near the *Heart* in a live Dissection teaches us: So it is puls'd out from the *Heart*, erecting the point upward, and cutting round about the Cone, by pressing the Finger immediately into the Wound; there is a Swelling, Tension, Hardness and Paleness of the *Fibres*; Contraction follows, Impletion does not precede it; Depletion or Emptiness attends the Shortness, Contraction or narrowing of the *Heart*.

If the *Nerves* of the eight Pair be tyed or cut ^{under} in the Neck, the Motion of the *Heart* grows languid, there is a Palpitation with the greatest Pain to



The Structure, Force and Action of the Lungs.
to the Animal, which in a short time ceases. From hence is dated the Origin and Continuation of the *Systole*, which yet stands in need of the Blood of the *Coronaries*, in every Muscle, and of that flowing in the *Cavities*, so by the *Systole*, the Blood being almost totally puls'd out of the *Cavities* of the Heart and its Vessels, the Fibres Flag, are weaken'd, stretch'd out, or made longer, the Distance betwixt the *Base* and the *Cone* is increas'd, the Pressure of the Walls on the *Cavities* is lessen'd or taken away, the Valves of the venous Passage towards the point of the Heart are drawn together by the annexed Columns, the contracted *Auricles* fill the *Cavities* as well as the *venous Sinusses*, this is the *Diastole* or natural Rest of the Heart.

For from that time we evidently know, that the *Cavities* of the Heart are fill'd with Blood, by opening of an *Artery* about the Heart, or cutting the Heart transversly when erect, and then we see it admitting not casting out the Blood; from Inspiration of the Animal, opening of it at the time of Death, for then we may perceive a Relaxation by putting of the Finger into the Wound: Therefore the Blood doth not flow from the Heart upon the Account of Rarefaction: And a small Quantity of *Chyle* added to a great deal of venous Blood, is mixed, divided, and shak'd together by the Strength of the Heart, and then the whole propell'd into the *Pulmonary Artery*.

The Structure, Force and Action of the Lungs.

WE are therefore to consider the Fabrick or Texture of the Lungs, as to its Vessels, and the Air and Blood that are contain'd therein; that from thence may be known the Effects happening to the *Chyle* and Blood in the Lungs. *Casseri* and

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Ruyssch say, that its Air Vessels are always naturally open from the chink of the *Glottis*, and form'd by the Concourse or Meeting of the two *Arytanoide Cartilages*, spontaneously elevated from the pressing down of the *Epiglottis*, and can emit or send forth Air by the Nostrils or Mouth. But the same Chink depress'd by the *Epiglottis*, from the *Arytanoides* being contracted, by the *Thyroarytanoide* Muscles, it hinders the Admission, and is shut against any other Bodies but Air; but where it is dilated by the postick and lateral *Cricoarytanoide* Muscles, thence it easily both admits and emits the Air.

From thence the cartilaginous *Aspera Arteria*, separated from the orbicular Segments, on the postick or back Part, and there furnish'd with a strong Membrane, being connected together with an able Musculous Band, renders it so, that the Air hath always Liberty to go in and out at the gaping Pipe upon the smooth slippery Sides of the Membrane; that it may be capable of expanding round and give way to the Deglutition of the Stomach; that it may yield or be pliant to the bending of the neck; and lastly, that it may be easily lengthen'd and shortned.

Afterwards, where it is cleft about the fourth *Vertebra* in the Breast, a little further it is divided into innumerable Branches, but more abounding with annular Segments, the Branches are posited at acute Angles one after another, by degrees becoming narrower and finer: Lastly, at their Extremities, with a cartilaginous Disposition becoming membranous, being extended by the force of the Air, the folding Bags make little yielding Membranes, the Slips of which grow to every extream point, from which the Vesicles, the Lobes, and last of all the whole Lungs as to the Air Vesicles are form'd or compos'd.

If therefore the fluid, heavy, elastick Air admitted by the *Glottis* into the *Trachea* and *Bronchia*, blown up these Tubes, Branches and Vesicles, the orbicular Largeness and Length of the Pipes will be increased: The Branches will rise into greater Angles; the Lobes are erected, the Vesicles from a flat Figure by Complication are extended into a round one. Hence the Spaces will be enlarg'd betwixt the squamous Segments, the Branches and Vesicles, and the Points of Contact lessen'd.

After this, the *Pulmonary Artery* growing presently curved from its Rise out of the *Heart*, is divided into innumerable Branches, distributed with those of the *Aspera Arteria*; it compasses the Superficies with the last Branches, by the Net work Texture of the *Vesicles*, possessing the middle Spaces betwixt these, after the like manner, which are call'd little Cells, and there abounding with an infinite Number of Arterial Inosculations, proceeds into the Veins.

Which, as *Ruyfch* observes, from the like bending or winding of the Artery, the Blood is so conveyed and changed, that the overflowing Secretions being scarcely distributed, they are brought back into the larger *Pulmonary Veins*, into the four great Vessels, by these into the *venous Sinus* of the Lungs, from thence into the left *Auricle* and the smooth Cavity.

From which Texture of the Lungs, and their Mutation by the Air, together with the swift thorough Passage of the Blood and *Chyle*, are understood the Effects produced in the chylous Blood by the Action of Respiration, to wit; first that that Humour by the immediate Force of the Pulse of the right *Ventricle* of the Heart, is thrust or compress'd into a crooked, conick, flexible, elastick Pipe, there being thicken'd and chang'd in the Contact of the Particles, and in the Figures or Form of these the Fluid is dissolved, broke in pieces, or maintained and held together.

§4. *The Structure, Force and Action of the Lungs.*

Secondly, From the Motion of the Vesicles inflated in the Lungs by Inspiration, leisurely press'd in fewer points; from the Change of the cellulous Spaces at the same time successively more encreas'd, from the Motion of the Vesicles and their Spaces, successively and by little and little lessen'd in Expiration, from the Elasticity of the Air, retain'd after Inspiration or Expiration, from the assiduous Increase by Heat that is perform'd; that for two moments successively together; neither the Arteries nor Veins, nor Blood, or any other Humours in whatsoever Vessels of the Lungs, are ever equally or after the same manner compress'd; but all ought to be adapted to the conveying Canals, which follow through the Lungs, by being reciprocally press'd, driven, conquassated, remitted, ground, broke to pieces and resolved.

Therefore 3ly, the *Chyle* is prepar'd in the Mouth, wrought in the Stomach, elaborated in the Intestines, secreted in the Laeteals, diluted by the Glands in the *Mesentery*, yet more so, from the Chyliferous Duct of the *Thorax*, jumbled together in the *Vena Cava*, accurately mix'd, soluted, attenuated and subdued in the *Auricle*, and the right *Ventricle*; strongly squeez'd or press'd in the Conick and Cylandrick Canals of the *Pulmonary Artery*, and configurated into the Form of the solid and fluid Parts throughout the whole Body.

4ly, It is exactly mix'd again in the *Pulmonick Veins*: And 5ly, By the *Lympha* in this Place, as demonstrated in the Blood, alter'd in its proper Organs, it is diluted in the same Veins. 6ly, It appears to be endowed with an apt Form for Nutrition: Then 7ly, Its Heat and Fluidity are preserved. 8ly, Thus is made the highest Mixture of all the Humours and Particles of the whole Body, both new and old. 9ly, And here seems first of all to be the Rise or Spring of that red Colour, which is the Property of good Blood.

But

The Structure, Force and Action of the Lungs.

2
But whether the heavy Parts, and the elastick ones of the Air, are mix'd here with the Blood, for the vital elastick Oscillation, as the Famous *Borelli* teaches? That cannot be done in the Arteries, neither is there any Argument why it should in the Veins. But the Air compressing in Inspiration, is believed to pass thro' the Vesicles or Bladders by extending the Veins: The compressing Force of the Breast binding the Veins in Expiration; here is a singular Commutation of the *Artery* into a *Vein*; the Passage of the Air is difficult into the small Pores or Holes that are pervious to Water, Oil, and Spirits.

The Blood is brought hither to be expos'd to the Air, either as a Refrigeratory, to expel the fuliginous Vapours, or to endow it with Spirits according to the Schools: But ocular Demonstration, Anatomy, and the Use of the *Thermometer* prove otherwise.

But whether we may admit the Blood of the right *Ventricle*, by reason of the fervid Effervescence in that Part, that is almost scalding or boiling hot to be condens'd, extinguish'd and refrigerated by the cold nitrous Air in the Lungs; for *Sylvius* and most of the Chymists were of this Opinion, but Experience reclaims it; or whether the Blood gains its Purple Tincture, from the subtil nitrous Air mix'd here with that Liquor, as the great *Lower* wou'd have it, yet Truth does not much favour him.

As we may learn from the former, so we may from the Event, that the *Chyle* is rather confusedly jumbled together in the right Cavity of the Heart, than accurately mix'd with the Blood; for we see it intimately united in the left *Ventricle* of the Heart, and know it able to perform all its Operations from the Strength and Efficacy of the Lungs. After being thus chang'd, it flows from the strait Arterial Canals into the broader Veins, it is push'd on by opposite Motions, is less press'd, but rarifies much

§ 3 The Structure, Force and Action of the Lungs.

more, hence growing more frothy, florid and red, it returns into the left *Ventricle* of the Heart, by this means a great Part of it is mixed again in the left *Ventricle*, where it remains fluid, and is hindred from Concretion and separating into Parts.

The Chylous Blood hardly resting in the left *Ventricle*, being puls'd by the strong and swift force of the *Systole* into the great *Artery*, protrudes whatever is before it, and so moves all. Therefore the Efficacy or Power of the Lungs is of much greater moment, than that of any other of the *Viscera*; because the whole Quantity of the Vital Fluid passes thro' them, while only a certain Part or Portion flows thro' any of the rest: Nay, farther here is Preparation made for Nutrition, because all the *Chyle* is brought hither, then in the first Place, this is the Office or Laboratory of the Blood, where it is made fit to flow thro' the smallest Vessels, which it could not otherwise do; wherefore it is most aptly prepared for Secretion; and lastly, for exercising all other Actions, which are necessary to be perform'd towards the Subsistence of Life and Health.

All these Things follow from the Disposition or Nature of the Blood and *Chyle*, as laid down, allow'd, or presuppos'd, from that of the Structure and Action of the Lungs, from the suppos'd Strength of the Heart, and the Force of the heavy, fluid, elastic Air, on the configured Air Vessels of the Lungs, together with those of the Blood. Therefore, what need of the Admission of Air or a Ferment? Those who are desirous of knowing more on this Subject, must consult the Works of the Learned *Bellinus*, *Pitcairne* and *Malpighius*, who are excellent in their Enquiries into the Nature, Structure and use of the Parts.

The

*The Strength of the Artery, and its Action on
the Fluids.*

THat those things may be farther understood, which relate to the Pulsation of the Blood and Chyle into the *Aorta*, and its remotest Branches, we ought to regulate our selves by the *Hydraulick Lemma*, with which the Fluids are directed by a suppos'd Swiftneſs thro' known Canals, and lead about towards a definite End: For these are otherwise demonstrated, and common to any Liquor moved thro' any Vessel. Their Swiftneſs are here measur'd from their Causes and Effects observ'd by the Senses, or known by good Reason, but Canals are known from Sense, Microscopes, Injections, Reason, or by this Rule, as things either sensible or insensible in a Human Body.

Therefore the *Artery*, by the Force of the distending Blood, is expanded, but when that ceases, it naturally returns to its former Capacity; for the Finger thrust in forcibly, is much squeez'd, but taken out again, it contracts of its own accord; in a live Animal the *Artery* appears full, in a dead Body small and almost empty; it resists being distended when blown into, and strongly repels the Impulse of the Air; sticking in the smallest Diameter of its Contraction it is at rest; wherefore its contractile Power depends on the Nature of the Fibres, and the little replete Vessels constituting the Membranes of the *Artery*.

Neither is there any sensible Particle in the whole Body, but it hath a small or minute *Artery*, as slight Wounds informs, or we may learn from the *Microscope* and *Injections*, according to *Leenwenhoek* and *Ruyſch*; yet all these are but lesser Branches of the *Aorta*.

The

48 The Strength of the Artery,

The Blood filling the Arterial Vessels, stops its Pulsation into the *Aorta*, the Conick Figure of the *Artery*, its Curvedness and Elastick Spring; the ambient Bodies pressing with their Weight, and lastly, the Narrowness of the *Capillaries* or remote Vessels does the same; therefore it flows thro' the Vessels from the Excess of the Heart's Strength, beyond those aggregate Bodies that resist; from whence it is apparent it may be driven thro' the Lungs with lesser Force of the Heart.

Yet the Strength of the Heart is accounted great, let us compute which way we will, as the quantity or plenty of the things moved instruct us; therefore because the whole Mass of Blood is at all times agitated with such Force, and repell'd or driven back with such a mighty Obstacle, in a full, conick, flexible, and strong resisting Canal; it necessarily follows, that the *Diastole* of the *Artery* is perform'd at the same time with the *Systole* of the Heart, that appearing not natural but violent to the *Artery* which is natural to the Heart. In a State of Health, there ought to be a Fullness of Vessels every where at the same time; to be felt, where the *Artery* is found large, naked and supported by a hard *Basis*.

And while the Force of the *Artery* is strongly thrust back again, contrary to this *Diastole*, and also the Power of the ambient Parts, assists that Resistance: The *Artery* thus supported, will necessarily push on the Blood, otherwise at rest, by the strong ambient Bodies with that Energy, whereby it contracts it self; from whence the Blood will flow with a continued Stream, tho' with leaping, and this is call'd the *Systole* of the *Artery*, timed equally with the *Diastole* of the Heart, which is natural and not violent to the *Artery*, assisted by the Return of the *Valves* of the *Aorta*, and the flaccid Emptiness of the *Coronary Arteries*.

These

These Motions are two-fold, which the Physicians calls the Pulses or Beatings of the Arteries, in which the Strength, Plenitude, Number or Equality consists, or their contraries; yet so, that the same are scarce common to two healthful People at the same time.

From hence the Blood being puls'd from the Heart with an oblique Force, it is thrown to a very acute Angle on the sides of the *Aorta*; pressing there it runs in almost with its whole substance into the crooked or curv'd Part thereof, from the Figure and Form of which, as well as the Resistance of its Weight, it is press'd back again, therefore in every moment of time, some Particles of the Blood, gain another Motion, Rotation, Attrition, Attenuation, Density, which are chiefly homogeneous to all, and from these follows the Fluidity, Heat and Colour of the whole Mass; a Division of Particles is made and accommodated to all the Vessels, hence Obstructions are hindred or prevented in the Capillaries; all which are assisted by the *Anastomoses* or *Inosculation*s allowed of by *Leenwenhoek* every where, and by *Ruyseh* almost in all the less and minuter Arteries of the Body.

But if all these should contain Blood in them, and yet want the Motion of the Heart and Arteries, the Blood wou'd soon thicken and approach more to the Nature of a Solid, but while it is urged on from its Causes, it remains apt or dispos'd for Life.

But because the Arteries increase by degrees in Number and Size, in one place narrower or straiter, in another broader, in all times and places many things are lost not to be restored; in the smallest Vessels the greatest Resistance, and that impress'd Force is communicated to many ambient Parts: Therefore the Motion of the circulating Fluids,
cæteris

So *The Nature, Parts and Phænomena, &c.*

arteris paribus, will be swiftest about the Heart, and slowest in places more remote.

The Nature, Parts and Phænomena of the Blood.

BUT in the Blood it self, the great Cause of this Diversity lies hid in the Velocity, and in the very Passage thereof; and because there are various things therein, its Origin must instruct us; the spontaneous Secess of Rest, adhering without the Vessels in a vaprous, serous, fibrous Form, and the *Chymical Analysis*.

Therefore there are in the Blood, first, things that are moved, or moveable by the least Force, as the smooth round Solids; 2ly, what are slower or duller, and not moveable with little or small Force, as things porous, angular, rough and viscid, from whence we are taught by Hydraulicks, Hydrostaticks and Mechanicks, that the Parts of the Blood are puls'd with the same common Strength of the Heart, and not mov'd with Velocity, Continuation and Direction; for the first recede from the Heart in a direct way, with a great and constant Speed, but the latter much slower, being drove thro' the Vessels obliquely or backwards.

But why shou'd the Blood remain some time fluid in the Veins of a dead Body, and yet coagulate quickly in the Heart and in the Arteries? Because perhaps the most fluid Humors being press'd, flow assiduously into the Veins, and nothing exhales from them, when the Fluidity is lost in the Arteries, neither does any thing return into them.

And tho' the Blood appears in Life every where alike red; yet viewing it by Microscopes, it consists of red Globules that swim in a thin subtil Serum that

The Nature, Disposition and Force, &c.

that is almost pellucid ; so that the Balls blown up, or form'd out of the six lesser things, are red, but resolved into Parts, they transform themselves into the Nature of a pellucid Serum, of which there are various Colours. Whence Matter, Substance, Figure and Colour are converted into Water ; it is more difficultly understood, how this Division is extended into lesser Globules, but it is known what the thicker red, and what the serous make, and therefore why they are so necessary in the Blood of a sound robust Man.

But from these things it will be easy to explain, what we ought to think of the *Galenical* or *Chymical* Doctrine, in accounting for the Nature of the Blood ; and conclude that the Variety of Blood in various Bodies, and from thence the Temperaments of different Men may be better understood, and deduced from Water, Salt, Oil and Earth ; in the mean time it is clear *a posteriori*, that the Motion only of the circulating Blood can perform and preserve its Mixture, Fluidity, Heat and Redness ; while Encrease or Decrease, the Absence or Presence thereof maintains or destroys it. Wherefore there is occasion to look into those things, which are done, while this Blood and Chyle is brought by the Force of the *Heart* and *Arteries*, into the *Arterial Capillary* Vessels about the small Veins, Glandules, Muscles, excretory Organs and *Viscera*.

*The Nature, Disposition and Force of the Arteries
entring into the Brain and Cerebellum.*

First of all we are to have regard to the Rise and Course of the *Carotid Artery* ; the *Aorta*, saith *Ruysch*, arising from the left side of the Heart ; soon after is carry'd upwards, and then forms the
Subcla-

62. *The Nature, Disposition and Force of the Subclavian* by an Archwise bending in the right Side, to which the right *Carotid* adhering for some space, it rises as if it derived it self from this *Subclavian*; but the left is erected from a single Arch. Presently both of them being defended by a deep Situation and the *Affera Arteria*, free from crooked Windings and Compression, scarcely sending forth any Branches, they reach the *Cranium* in a direct or strait Course; where being almost arrived, they bestow, according to *Bartholin*, an external *Carotid*, as *Lower* says, furnish'd with an *osseous* or bony Canal, winding or turning forward, laid down with a musculous Membrane, giving Branches with *Ridley* to the *Dura Mater*: Within the Brain they are defended from the *Sellian Sides*, and the Rise of the *Dura Mater*, after they are sent forth into the exterior Parts of the *Pia Mater* and the Nerves; and then are committed to the Brain, by means of the *Pia Mater*, where presently they are divided into lateral, anterior and posterior Branches.

But the *vertebral Arteries*, which *Cowper* mentions in his Appendix to *Bidloo*, being stretch'd upwards from the superior Part of the *Subclavians*, are presently receiv'd among the seven lateral *Foramina* of *Vesalins*, there defended, and brought to in a direct Road, being supply'd with a vaginal membranous Covering, where they issue out from the *Foramina* of the *Vertebra*, immediately under the superior Process, made crooked, according to *Cowper* and *Ridley*, from the posterior Bending back of the first *Vertebra*, and there made broader, they enter in by the great *Foramen* of the Skull, are united, says *Ridley* and *Ruyfch*, by laying down a grosser Membrane, then joyn'd to the *Carotids*, it is presently divided after a wonderful manner.

Therefore the Four *Arteries* going out from opposite sides into mutual Apertures, as *Ruyfch* saith, and so set together in an orbicular manner, from whence

Arteries entering into the Brain and Cerebellum, whence they presently send out Branches, which meeting with others of the like nature, they again form such lesser Circles, and by the same Arteries seeming to be divided thro' the whole Superficies of the *Pia Mater* into Subdivisions, they almost disappear, that this whole Membrane is chiefly made up of this Texture.

After this manner, from a *mechanical Apparatus*, all the Blood is moved or driven from the Heart, which comes to the thin, slender Membrane of the *Brain and Cerebellum*, and from thence to the Substance of both these, for the remaining Blood which is driven into the *Cranium* by the Two *Arteries*, says *Ruyfch*, springing from the external *Carotid*, entering from thence by a single *Foramen* into the Skull, and distributed in the hard Membrane of the Brain, properly said to be the gross Integuments of the *Cerebrum* and *Cerebellum*, as the Vessels show us when fill'd with Wax, from the accurate Industry of the famous *Ravus*.

From whence we clearly discern, that the Blood before describ'd from its singular Condition, how greatly soever retain'd in this Disposition, being brought to the lower *Superficies* of the *Bas*is of the *Cranium*, is there freed from the Matter of the *Saliva* and *Mucus*; or purified from the tenacious Blood given to the *Vertebrae*, blunted by the Flexure of its *Artery*, refined slowly in the Caverns made by the Sides of the *Ephippium* from the *Dura Mater*; and by opposite Strokes it runs into the Vessels, thro' the rest of the *Arteries*; from whence, first, it preserves its own proper Nature, or acquires a greater Purity, the too great compressive Shock or Violence weakens the soft Pith of the Brain. 2ly, An exact Mixture of all the Blood brought hither, is perform'd, and therefore the greatest Likeness of it in every Part. 3ly, Attenuation, Levigation, Trituration, Fluidity, an Aptitude or Readiness for Secre-

The Cortex of the Brain.

secretion, and an Impediment to Concretion. 4ly, A lesser Vibration of the *Arteries*, and less Action of these upon the Blood. 5ly, A Supply of the Defect arising from the Unfitness of the larger and lesser Vessels, fram'd for transmitting of Liquors, when there is a free Course from every side, into any of them.

The Cortex of the Brain.

BUT those very *Arteries*, interwoven after so strong a mannner in the fine slender *Meninges*, as *Ruyfch* calls it, as in a *Basis*, send forth Branches, according to him, from every Part thereof, with almost a perpendicular Course, being made up of such alike *Apparatus* of Inosculations, as furrowing Rounds and Turnings on the Membrane by its Insinuation, and making them deep, into which the exterior Substance of the Brain and *Cerebellum*, is divided almost to the very Marrow it self. But those Tracts, being wound or turn'd round after the manner of the Intestines, may yet be resolv'd into others lesser; yet like the former. The Substance lastly, that lies betwixt, exceeding the greatest part of this and what is in the *Cerebrum* and *Cerebellum*, being fill'd with an Injection of Wax then steep'd in Water, and freed from every Part not full; there will appear an Heap of Vessels, like a Lock of Wool, that are smaller, softer and more succulent, being dissolveable with the least Force, melting in Spring Water, by hanging only therein, into a pulpy Humour.

The exterior Part, according to *Vieussens*, is cineritious, or of an ash Colour, soft and moist, and this Substance is call'd the *Cortex* of the *Cerebrum* and *Cerebellum*; it binds in or encompasses on all sides curiously, the whole Origin of the internal Substance that

The Cortex of the Brain.

that is whiter, more solid and dryer, which is called the *Medulla* or Marrow of the *Brain* and *Cerebelle*; so that this in the first place appears plainly to arise from that on every side, both in the *Appendixes*, *Ventricles*, *Crura* and *Medulla oblongata*; but in the inward part it is like the *Cortex* of the *Medulla spinalis*, or spinal Marrow, but of a closer Substance. Tho' in the *Cerebelle* this is so clear, that the manner how the Marrow proceeds from the *Cortex*, is made very evident from the Distinction, Proportion and Texture thereof.

Therefore since from every single Stroke of the Heart, a very large Portion of Blood, which *Malpighius* reckons a third of the whole, is driven from the *Cortex* with a great and direct Force, that will be agitated at every *Systole* and *Diastole*, tho' it be very small. But likewise there ought to be venous Ducts every where posited at the Ends or Extremities of the *Arteries*, tho' they cannot be made visible, thro' the Fineness of their Membranes and their Substance: There ought also to be certain secretory Ducts, at the extreme *Capillaries* of the finest *Arteries*, tho' these are not visible.

This Minuteness of the Parts makes it, that Reason with all its Endeavors is not strong enough to supply what Inspection denies, as several have thought; yet the Opinion of *Malpighius* chiefly, being every where received, led us into this altogether from the Fabrick of the Gland, till the accurate *Ruyseb* publish'd the contrary, who is a Man excelling all in discovering, explaining and preserving the minutest Arterial Vessels of the Body, whatever is to be taken notice of from the Glands, must be had from the eminent Discoveries of *Silvius*, *Steno*, *Wharton*, *de Graef*, *Malpighius*, *Billinus*, *Borellus*, *Peyerius*, *Ruyseb*, and *Nuck*.

Of these, first, some are simple Glands, others compounded, many of these arising from those,
F while

while aggregated or joyn'd together, they are cloth'd with a common Membrane. 2ly, The simple either mix a proper Humour thro' their Lymphatick Ducts, with *Chyle* or venous Blood; or they exhale into the exterior Parts of the Skin, or the Superficies of the opener Membranes to be found every where throughout the Body: But the compounded Glands emit their Humor or Liquor made in every single, Part, from thence, thro' their little Canals into the larger Ducts, and by this common Emissary, at last they break into the greater Cavities of the Mouth first and the Intestines, or else out of the Body it self into particular Uses; the first are call'd conglobate, and the latter conglomerate Glands.

The simple Glands are compos'd of, first, a certain exterior and thin Membrane, to which another being plac'd under, strictly adheres: The former incloses, binds, and compresses it on every side with its circular Elastick Fibres; chiefly consisting of a Texture of small Vessels going in and out: The latter is indeed thick and stronger, with Fibres appointed for almost every Turn and is made up of an intricate Texture of Vessels, which serve it formly for the same Uses. 2ly, These Glands receive Arteries, the Branches which they distribute and maintain in their Membranes by an orderly and fix'd Series, so accurately or nicely brought to every minute Particle of the Gland, that Wax or Quicksilver being injected, increases the little Arteries, by compressing the other Vessels, that it seems falsely to teach us, that its whole Structure was only *Arterial*. 3ly, These Glands have Veins dispos'd in the like Course with *Arteries*. 4ly, They receive many Nerves and those greater than any other Part of the Body, of such a Size which are likewise so divided in this Corpuscle, that they seem to enter the rest. 5ly, They have last of all receding

The Cortex of the Brain.

ding and communicating Lymphaticks, according to *Nuck*.

But these Canals of the *Artery* are conick, inflected, ramous, elastick, wound round or wrapt up, and in the Extremity Cylindricks, not branching further, but are now chang'd into Veins; but before they are thus chang'd, the little Arteries, by infinite Inosculationes and various Positions, so communicate amongst themselves to innumerable Angles, that as *Ruyfch* says, these extreme Ends terminate differently in different Glands.

Therefore great Motion happens from the *Arterial* Blood, being driven to the Glands; vast Resistance; Compression; mutual Pressure on the Parts; oblique Pressure; an assiduous thorough Change of touching; Application every where manifold, and that to the least or smallest Points of the Capals; various Rotation every Moment in some particular Part; opposite or contrary Pressure, departing into the Branches; but returning into the same, Attenuation, Attrition, Conservation of Fluidity, Solidity, Smoothness, Secretion, Mixture.

In the mean time, most part of the Branches arising from the Trunk of the *Artery*, are more compress'd, stopping in the same Place, so it is in the minutest; and therefore the extreme Branches are less in the extreme or last Trunk; the last Trunks transmit the red, thick part of the Blood, which they deposite into the Beginnings or Entrances of the little Veins; the straiter or narrower Branches receive the thinner, more fluid, pellucid Parts, lesser in the Diameter of its opening, being press'd by an oblique, strong opposite Force.

But this subtil Humor, separated from the gross or thick Part, is not the Blood it self, but something else different from it; Sweat, perspirable matter of the Pores, Tears, Ear-wax, Mucus, Spittle, Snor, Lympha, Serum, Bile, Semen, Oil, Milk, Fat, &c.

Furthermore, the last Branches are term'd *Arteries* from the Nature of their Fluid, and are often endowed with the Properties of an *Artery*, having the finest subtil *Arterial* Branches, as well as *venal* ones: Hence *Veins* and *Arteries* are of equal Use to the *Lymphaticks*, as to convey or carry Blood; neither is it known where the End of their Progress is, but only as we understand the Origin, Progress, End and Function of the *Lymphatick* Vessels.

Yet the Branches perhaps of some such like *Artery*, not so much branching, as strait, and disposed in a fine thin Membrane of the smallest glandulous Bag or Vesicle, their Mouths being open in the end, they spue out their Liquors into a common Cavity made from that little Membrane, where being collected on all sides, it adheres somehow, and is that glandulous *Lympha* there made and gather'd together.

But credibly it may make the Nerves of the Glands from such alike *Apparatus*, spue out their Spirits, and mix them with the *Lympha*, and so supply those Duties that depend on its Nature. In the mean time, the *Lymphatick Arteries* often bring their *Lympha* deliver'd from their valvulous little Veins, call'd the vasculous *Lympha*, to these Glands, and send it by a different Preparation of the glandulous *Lympha* into the same Bag, and mixing with the Spirits, render what is sent in more subtil. Then that compounded Humor passing thro' the *Lymphatick* Veins, agitated by the contractile Force of the fibrous Membrane, the Motion of the *Artery* and Pressure of the Muscles, is push'd into other Glands that are there, at length passing it into the Cistern upon the Loins, the Thoracick Duct, or the sanguiferous Vessels of the Body, and these conglobate Glands are seen throughout the whole Body.

But there is another Reason of other things, while that little Bag or Bladder expells its received
Liquor

Liquor immediately by its Emissary into some common Cavity; as into the frontal *Sinusses*, the Hollows of the upper *Maxilla*, the little Cells of the *Sphenoid* Bone under the *Ephippium*, the lurking Holes of the spongy Bones in the Nose, the Cavities of the Nostrils, the Furrows or Trenches of the *Tonsillæ*, a secreted *Mucus* is deposited, collected and chang'd: So the Passage of the Mouth, the Ear, Jaws, *Larynx*, *Affera Arteria*, *Bronchia*, *Gullet*, *Stomach* and *Guts*, appear to have in the mucilaginous Glands; which may be call'd *simple excretory ones*.

There are others again with the like Appearance, that emit digested Humors thro' proper Emundories, arising from a Cavity that is without or upon the Skin. Hence we may take notice of the distance of the *Artery* from the Heart, its Situation in respect of the Heart, and the Trunk from whence it arises, its various Complication, the different Swiftmess thro' it, the singular Proportion of the Branch to the Trunk, as well as the different Force expressing within and without, the Stoppage or Test of the Fluid in the common Duct; the Distribution thereof into Places that change or alter the Humors again by their Structure; the most liquid Part of the secreted being exhal'd or separated, makes it so, that from the same Blood, a Humor abounding with great Variety is secern'd in different Places, and the secreted wonderfully chang'd.

Those Causes that are different in different Parts of the Body, either alone or combin'd are discover'd in the very Structure it self, naked or expos'd to the Senses, or are deduced from the Fabrick, with the greatest Evidence by certain mechanical Laws, and by the easy Knowledge of the Nature of the Humors in all, from whence then may be understood the innumerable Species or Kinds of Secretions and things secreted.

Further, not to puzzle the Cause with Fiction, we do not allow of Pores, to be endowed with any certain, various or immutable Figure, especially since it is repugnant to the Laws of Nature to allow of any such; much less to be an Advocate for any conceived Ferments, from a kind of thick or fluid Mass; or any other Fermentation, Precipitation, Coagulation, Assimilation or Alteration; since for these there can be ascribed no Cause, original Matter, Place, Mixture, Efficacy, Proportion, Durableness, Effect or End.

But from these simple Glands describ'd, or from others like to them, united among themselves by common Vessels, and all together connected by a common Membrane, are produced compound Glands, call'd *conglomerate*; in these there is chiefly one common Emunctory, which receives the Humor sent in from the rest of the Emunctories of the Parts, collects or gathers it together, and pours it out into some large Duct or Cavity: Such are those of the *Innominata* of the Eye, the *Parotid* and *Pancreatick Duct*, together with that common Receptacle ending in an *Emunctory*, which often goes as it were into an *Arterial* crooked Vessel, changing or altering the Humors, and from thence pouring them out by an *Arterial Apparatus* into an open Channel, as in the masculine *Tistes*, in *Higmore's Duct*, in the *Epididymis*, the *Vas deferens*, and the *Seminal Vesicles*; or 2ly, it presently breaks out into the common Emunctory.

Here we ought to know, that by Assistance of the Glands, there is separated from the *Arterial* Blood, Water, Lympha, and a thin Serum, and with these are mix'd Salts, Spirits, and the subtil Parts of Oils; but all these things, either stagnating in certain Places, are charg'd and accumulated, or else are driven thro' the lesser Vessels, even to the minutest Parts of the Body, serving for Motion and
Nutri-

The Cortex of the Brain.

Nutrition ; from whence they either return by the little Veins into the Heart, or else are exhaled ; lastly, that Part of the Blood, which after this Labour remains in the *Arteries*, enters the Veins, which by little and little grow wider, in order to be mix'd with the like Blood, to be diluted with the *Lymph*, and return into the Heart.

Wherefore the *Arterial* Blood being most diluted about the Heart, grows by degrees thicker in the End of the *Artery*, that is in the Beginning of the Vein thickest, easily concreted, and is highly viscons ; therefore it requires an unactive Vessel to prevent it, and the Mixture of a diluting Humor, that is, the *Lymph*, which performs it by its Office, and the Return of the Spirits towards the Heart : But these things ought to happen before it is puls'd into the *Pulmonary Arteries* ; for otherwise the Blood wou'd be sufficient to do it with one single Circulation only.

Hence we ought to know the Place where the Certainty of Life and Health are chiefly to be tryed or hazarded ; to know what Service the larger Vessels, the groffer Humors, the small Vessels, and the fine or subtil Humors afford to the Strength, Hardiness and Flexibility of the Body ; to understand why the Veins by degrees more open, yielding to the Concourse of Humors, and apt for Dilution, perform these things before the new Return of Blood into the Heart.

But some Glands seem to be form'd from another Structure ; so that the *Artery* conveying the Humors, gives a thicker Blood by a social Vein, that opens by *Anastomoses*, from the Artery into the Vein ; but going on from thence alone, and complicated in Windings and Turnings, from its last Mouth it throws into the common Receptracle a singular Humor, prepared and rising from the Blood, but distinct or differing from it.

Therefore since *Hippocrates*, *Wesferus* and *Malpighius*, have diligently compar'd the Cortex of the Brain, with the Structure of a Gland, being convinc'd by the Eye from the plain Resemblance, they were of Opinion, that the Cortex was really glandulous. But *Malpighius* hath defined these Glands to be angular and of an oval Figure from the Compressure of the neighbouring or adjacent Parts, posited crookedly and small, being tyed together with others, first of all making them a little bigger; from hence again growing large, at last from a Collection of these together, making a Substance like the Convolution or Winding of the Guts, and from these the outward Cortex; so that the minuteſt or ſmalleſt Sprigs of the *Carotid* and *Vertebral Artery*, being here wound up into the Structure of a Gland, by their infinite fine Mouths they may exhale a ſubtil Humor from the approaching Blood, filling drop by drop from its little Bag or Bladder, from thence afterwards is driven into the Emunctory, and from that by the little Veins reduced into the *Sinus*.

The Eye and Microscope both favour the Opinion of *Malpighius*; Boiling divides the Brain as it were into little delicate Subſtances like Glands; a Detention of Ink being poured on the Cortex, deſcribes little Pieces diſtinct with Cleſts or Chinks; the Concretion of a morbous Brain into a Stone, is like a Mulberry; the Corruption of the ſame conruſed, by opening of the broken Skull, is like a glandulous *Fungus*; the Change of the Parts conſtituting the outward Brain by a *Dropsy*, as into plain little Globules or ſpherical Bodies.

But whether that laſt extreme little Branch, is rather it ſelf made from a ſtrait Continuation of the fibrous Part, afterwards drawn out, as the Origin of the Subſtance of the Brain, as appears from *Ruyſch*, we can draw no certain Argument, becauſe of the Fineneſs, the Extremities thereof vaniſhing from the
utmoſt

The Cortex of the Brain.

utmost point of our Eye sight. Yet it is highly probable, this Opinion arises from many and weighty Reasons, at least the Effects may be understood to be almost the same in either Case.

For this reason those last Sprigs or Branches, or those glandulous minute Bags according to the same Author, send forth fine white compact Fibres, with which being united together, is made the callous medullary Body, to which the *Cortex* growing to, lies upon it, and is knit to it, as well in the Brain as the *Cerebellum*; so that there is no end of the cortical Substance, where the Beginning is not likewise to be found of the same callous medullary Body.

But that cortical Machine so accommodates it self to the medullary Body, that it increases not extrinsically by the same means in the Brain and the *Cerebellum*; but it accompanies the last *Appendixes*, saith *Malpighius* of the callous Body, the *Ventricles* of the Rise of the spinal Marrow, and the oblong Tract of the same without the Brain; yet so that the enclosed *Cortex* according to *Ruyfch*, sticking betwixt the medullary Part and the *Sinus* intercepted in the middle, it is irrigated or water'd with a numerous Quantity of Arterial Vessels.

And therefore in all Parts of the Head, where the minutest *Arteries* that are scarce visible with invisible Veins, that are yet so necessary as to be admitted here, run together; there this cortical Substance is found, both in the Recesses, Circumvolutions, openings Interstices, and *Appendixes*, as in the external Superficies, in regard to the Skull: Therefore from every point of the *Cortex* saith *Vicussens*, when any medullary Substance pusheth out, that in the beginning of its Rise will be very small, but being joyn'd to other the like Parts, by degrees it grows bigger; and at length, sensibly rising out, it forms the Marrow of the Brain, the *Corpus Callosum*,

The Cortex of the Brain.

See, the *Crura* of the oblongated Marrow, the *Tabulae*, or Chambers of the optick Nerves, and agreeable to *Willis's* System, the oblongated *Medulla* and its *Crura*, with the *Fungus* or Swellings, as well as the *Medulla* of the *Cerebellum*, and its Productions into the oblongated *Medulla* of the *Brain*; which receiving these into *Ridley's* Pyramidal and Olive like, Bodies is stretch'd out into the spinal Marrow: But from this Medullary Substance, as well within the *Cranium* according to *Willis*, as within the Sheath form'd within the *Vertebrae*, all the Nerves derive their Origins.

But since these first separated Filaments or Threds appear distinct from each other, yet when they are united, they seem to make one compact Body; it is plain we ought to consider these Things. First, Their Rise, Elements and Progress, while single: 2ly, The cruder or boil'd Brains of Fishes, Hares, Sheep and Oxen, in which the manifest cylindrical Fibrils appear weigh'd down after the Form of Teeth, naturally join'd into each other. 3ly, The fine small sanguineous Vessels plac'd amongst those Fibrils, make a plain Division. 4ly, The *Cortex* posited betwixt the ambient *Medulla*, in the very middle of the spinal Marrow. 5ly, The white Fibres dispers'd thro' the middle of the prostrated *Cortex*, in the back Part of the spinal Marrow, as yet latent within the *Cranium*, and to the Sides of its beginning, yet being in the *Cranium*, best of all in the *Appendixes* of the callous Body, and in the *Cerebellum* it self. 6ly, The Collection and Distribution of the Medullary Fibres into the oblongated *Medulla* and from that into the Nerves.

Such a Course or Progress of these Fibres is plainly discern'd; First, From every Part saith *Vicussens* of the cortical Sphere surrounding the Brain, these distinct Fibrils making as it were the Center of the Sphere; so that in the first place they form the
Medulla,

The Cortex of the Brain.

Medulla, but afterwards reflex from that, they are brought together, on the upper Part, into a callous Body and an Arch, but below, into the anterior and posterior *Crura* of the oblongated *Medulla*, and into *Willis's* annular Bunch or *Fungus*. 2ly, Rising and collected after the same manner from the *Cerebellum*, they are committed to the preceding ones gather'd together; but so, that they joyn by these three different ways. 3ly, Hence all being united from either Origin or Beginning into one Bundle, they form one Spinal Marrow according to *Vicussens*. 4ly, *Malpighius* saith, that from the *Cortex* within that, arise the like Fibrils on every side, and from every point thereof they joyn themselves to the Superficies of the *Medullary Cava*, are united with that, and give a new Increase thereto.

Therefore since this Fabrick or Structure is thus constituted, there is an evident Reason for the Substance, Figure and Position of the *Cortex* of the Brain; and it is plain such like cou'd not conveniently have been, unless there had been *Cavities* and *Ventricles*, from whence the Necessity of 'em appears, whilst they are of use together, that a mutual Impediment is removed in every Part of the *Cerebrum*, and so Liberty given to the whole Marrow; from whence also the Rise of the Swellings or Bunches is discover'd, which are found in various Places in the Brain, while there are fresh Supplies of *Medullary Fibres* that happen in different Parts.

But it is scarce credible that the *Medullary Fibres* of the *Cerebellum*, from the inferior Place of their Connexion, should ascend backwards towards the Fore Part of the *Medulla oblongata*, and from the Nerves there arising out of the *Medulla* of the Brain, give likewise some that spring from the *Cerebellum*, always preserving an accurate Distinction of its Origin, Progress and Function: For it is manifest in contemplating, according to *Vicussens*, the various
Insertions

Injections of the *Medulla* of the *Cerebellum*, into the *Medulla oblongata* of the *Cerebrum*, and from thence the growing or rising Substance thereof; as also from the Consideration of *Willis's* spinal Nerve, out of the very Sheath of the *Vertebrae* going backwards into the *Cranium*, that it may join it self there to the Nerve of the eighth Pair. But the rest of the Fibres of the *Cerebellum* are so mix'd with the Fibres of the Brain, that there is scarce any Part of the whole *Medulla oblongata* and spinal Marrow, where the Fibres as well of the *Cerebrum* as the *Cerebellum* are not found mix'd together, and therefore enter the Composition of the Body of every Nerve, always and in every Place concurring in different and distinct Effects.

Whoever contemplates, 1st, the explicate Nature of the *Cortex*, and from thence, the distinct medullary Fibres arise: 2ly, Also the Resemblance of this Operation with every other Part of the whole Body. 3ly, The vast Supply of fine, pure, moveable, arterial Blood, not deprived of the subtil Part, but driven thus far by the great force of the neighbouring Heart. 4ly, The subtil Liquor or Juice open'd betwixt the Medullary Substance, every where to be discover'd by the Taste or Sight, and first of all found out by the *Microscope*, which is oftentimes much augmented in Disaffections of the *Cerebrum*. 5ly, The Veins from the *Pia Mater*, the *Cortex* of the *Cerebrum* and *Cerebellum*, returning the Blood back again into the *venous Sinusses* by the Veins from the Heart. 6ly, The assiduous regular Proportions of these very *Stamina*, from the first point of Life to the last Period, their increase Nutriment, spreading Shoots and Reductions; he must judge these slender little Canals to be pervious, which receive into them an Humor or Fluid which is indeed the subtilest or most refined of the whole Body, prepared

The Cortex of the Brain.

pared by the wonderful Structure of the *Cortex*, directed, and driven by force into these Pipes, from every Part thereof collected into the *Medulla oblongata*.

For if he will again weigh or consider: First, the Nature or Disposition of that Blood, which is call'd hither by the *carotid* and *vertebral Arteries*, and its Difference from the whole residuary Mass of Blood. 2ly, Its subtil or fine Structure vanishing as it were into a fleecy Vapour, and flowing of its own gentle accord, thro' the small *Arteries* arising from the Carotids and Vertebrals, composing by their inscrutable Foldings and Continuations, the Texture of the *Cortex*. 3ly, The particular Nature of this Humour, which being contain'd in these Canals, can be readily exhal'd of its own Nature, and will not harden at the Fire, but will be presently found evaporated into Air, while the rest of the Humours of the Body grow thick before the Fire; or are us'd to leave much *Fæces* or Dregs behind. 4ly, The Strength and Celerity, which its Effects being daily observ'd teach us, is in the Nerves and Muscles: He may easily believe that the Parts which compose this Liquid, are the most solid, fine, moveable, simple and fluideft of all the Humours of our Body.

For while it is beheld with *Microscopes*, as *Leewenhoeck* hath every where shewn, the red Part of the Blood is the thickest of all the Mass of salubrious Humours; at the same time the *Serum* whose Parts are much finer or thinner, can be divided into Corpuscles of an incredible Fineness as it appears, according to *Malpighius* in an incubated Egg when the *Fœtus* quickens, where the Humour of the white of the Egg is so successively attenuated, till it is made fit to flow thro' all the small Vessels of the *Embryo*, beyond Imagination: And in Insects the Vessels that are infinitely fine and various, are penetrated by their Humours, which are yet observed to be much smaller

matter in the human *Semen*, according to *Leewen-
hoek*, from whom it will appear that the finer Parts
of that Fluid seem to be much less than they were
commonly thought or imagin'd to be.

And we may truly assert this Humour to be of a
quite different Nature, from that which is compos'd
of any Sorts of Salts, that are to be demonstrated
by the utmost force of Art; because all its Proper-
ties how great soever retire hither, much less can the
Oils hitherto known enter into the Composition
thereof, since they are Enemies to the Passages of
these Fibres. Neither is it like to Spirits produced
from a vegetative fermenting matter; because these
if they are simple or without Mixture, they render
their Fibres dry, and unable to perform their Fun-
ctions; wherefore those have an Analogy to the
most subtil Water perhaps that of a Spirit, as having
the greatest Resemblance thereto, in Mixture,
Moveableness, Solidity, Softness, Simplicity, void of
Elasticity; yet the Mutation or Change of Liquor
in an incubated Egg teaches us, those Things are
produced from other matter.

Again, we are convinc'd that there is a great
Quantity of this Humour, in every moment of Life,
that is free from *Diseases* renew'd, or made fresh
again; notwithstanding the Size of the *Carotids* and
the *Vertebrals*; the strait Road or Course they take,
which is free from all Hindrance or Obstruction,
the great Plenty of Blood puls'd, the larger Motion
by which it is push'd on, and the Magnitude of the
cortical Composition which evidently show it.

And because the *Apparatus* of the whole Head-
piece, is furnish'd with an osseous or long covering;
it is not compressed with any ambient Fat, or any
other Body, whether Muscular or the like; but the
Arteries themselves, and the *Sinusses* run always in a
direct, secure, Road.

The Cortex of the Brain.

In the mean while, the *Medulla oblongata* and spinal Marrow being compos'd of a Collection of medullary Fibres, emit or send forth from within the *Cranium* as *Willis* saith, in Twenty different pairs Ten Pair of Nerves falsely so call'd; many of which being indeed compos'd of several distinct and large Nerves. But *Vienissins* affirms, that out of the spinal Marrow, there issues from without the *Cranium*, after the same manner Thirty Pair of Nerves; and one Pair out of the Sheath of the *Vertebra* of the Neck, about the fourth Pair of Vertebral Nerves, which increasing by degrees as it rises in Branches and Thickness, is joyn'd to the eighth Pair.

All these Nerves, while they are hid within the *Medulla* are pulpy, from their very Rise out of the *Medulla*, they derive a Sheath from the Membrane call'd *Pia Mater*, defended with which they proceed to the *Dura Mater*, which is bored through, transmitting the Nerves into open Sheaths, stretch'd out even to the very *Foramina* of the *Cranium*, and there with this Sheath taken to it self, they pass thro' the new first Pairs, and the accessory Pair, with a wonderful and safe Course out of the *Cranium*; but the other Thirty and One Pair arising by the artificial Spaces, amongst the junctures of the *Apophyses* of the *Vertebrae*, grow broader as they descend downwards: From whence issuing out shortly after, as *Ruyssch* says, firmer, harder and better fenced, or cover'd, they are dispers'd thro' all the smallest Parts of the Solids, as already observed.

But the Coverings of those Nerves, according to the last named Author, are every where supply'd or furnish'd with sanguiferous, lymphatick and other Vessels by a close Texture, from whence they are necessary, not from the Nerve alone as such, but from the Collection thereof and Fibrils, to show an intelligible *Phanomenon* of many Diseases in the Nerves.

But

But where the last Ends of the Nerves entering the Parts to which they belong, depofite again the Coats or Tunicles they firft acquired or receiv'd, a little after they are expanded either into a fine thin kind of Membrane, or elfe into a foft Pulp.

Whoever confiders diligently: Firft, That the *Medulla* or the whole vafculous Marrow is beftow'd or confumed in forming the Fibrils of the Nerves, nay, that it is fpent upon 'em, by a fingle continued Extension. 2ly, That from a Compreffion, Decifion, Putrefaction or Wafte of the *Medulla* of the *Cerebrum* or *Cerebellum*, every Action accuftomed to be done by the Nerves, arifing from thence prefently ceafes, although the Nerves remain whole, and the Membranes are untouch'd. 3ly, That the Nerves themfelves every where being lax, hanging, crook-ed, going backward or oblique, yet readily perform their Office of Motion and Senfe. 4ly, That being comprefs'd or bound, tho' whole and perfect, the Nerves lofe their whole Power of Motion and Senfation in thofe Parts, which is betwixt the Ligature and the extream Parts, to which thofe Nerves are fretched; but they maintain their Faculty or Strength betwixt the Place of the Ligature and the *Medulla* of the *Cerebrum* and *Cerebellum*; he will certainly conclude, that the nerveous Fibrils constantly receive an Humour from the *Medulla*, and transmit it to every Part of the whole Body, by diftin& Paffages, and that this is the Method only, by which every Function is duly perform'd.

Neither is there any other way whereby to eftablifh an Opinion, unlefs we affert, that the Nerves perform every Action by Vibration, depending on a tenfe Fibril Pulfation, which is repugnant to the Nature of a foft pulpy flaccid Nerve, and efpecially to that accurate Diftin&tion, whereby the Objects of the Senfes are represented, and the Mufcular Motions tranfacted.

There-

The Cortex of the Brain.

Therefore as the Arterial Blood and Lymph is perpetually moved or driven into all Parts of the Body, made up of such Vessels; so we understand in every moment of Life, that there is an Humour propell'd from the *Cerebrum* and *Cerebellum*, by the force of the Heart and Arteries, thro' the Nerves, into every point of the Solids, and that this Humour is prepared from the cortical *Cerebrum* and *Cerebellum*.

At length the Tenuity or Firmness of Ray's vasculous *Fleece* in the *Cortex*, which as yet is only Arterial at first, and therefore incredibly thicker in the last lateral Emissary deriving it self thence, teaches us how slender those nervous hollow *Stamina* are; but the great Substance of the Brain compar'd with this Smallness of every Fibril, demonstrates the Number of them to lie much beyond the Limits of Imagination: Again, the great perpetual violent Action, makes a Plenty of Humours be driven hither, so that there is a constant Fullness, Aperture and Action of those little Canals.

Yet in the mean while we are perswaded, that the Motion of this Liquid thro' these Vessels wants a great deal of force; although the Number of the Arteries, their Smallness, Crookedness and Texture, as well as the Number, Fineness and Winding of the Nerves, their various Hardness in different Places prove the Motion equal and constant, yet the Flux thereof is small.

Therefore whether it appears wonderful to you, that the Eye cannot trace the Presence or Motion of this Humour. That Ligatures, Wounds, Punctures, Suctions, Injections, are not sufficient to show it? That the Cavities of the Nerves are not by any Art demonstrable? Certainly he that reflects upon this seriously or tries to discover it, knows not the Nature of those Vessels and their Liquor. But he that trusts to his Eyes, following Art, and

consequently derives the Cavities of Vessels he cannot discern, he certainly knows not the Nature and Reason of the human Body in its Origin, Progress, Operations and Excretions; he understands not the Fabrick or Structure of Insects; observes not lastly, those Things which evidently happen to Plants.

But the Error would be greater still, to acknowledge the thick *Lympha* that flows from the Nerves cut in the Tail of an Ox or Cow, for that Humour we have now describ'd, neither does a Liquor injected into the *Carotid* of a live Animal, ringing the Nerves, show that they are hollow; nor is a Tumour or Swelling that rises upon binding the Nerves of a young Man, a sufficient Argument to prove the Enquiry; for that Humour from its Simplicity, Subtilty, Moveableness, perfect Volatility, is call'd the Spirit of the Nerves, and is Vital or Animal; of which hereafter.

But since it is every moment renew'd, and therefore the latter pushes on the former, its Function is shown from its last Office, to be driven from the utmost or extremest Filaments of the smallest lymphatick Veins, as well about the Glands as elsewhere, from thence to the much larger Lymphaticks; and again from these to the common lymphatick Vessels, which are Veins furnish'd with Valves; lastly, into the Veins themselves and into the Heart; and so to perform a perpetual Course or Circuit, like the rest of the Humours thro' the Vessels.

But whether it seems more probable, that this Humour should be stop't last of all, in the secret Passages? Or rather to believe that it flows back again into the first, from whence first of all it took its Rise? Or lastly, do we think it exhales from the Body? Indeed these are not very likely.

At last the Blood of the *Cerebrum* and *Cerebellum* being deprived of the secreted Spirits, is driven into the Veins of them both according to *Vienssens*, from these

these saith *Ridley* into the *Sinus* or great venous Receptacles, from whence without an Artery attending, thro' the *Foramina* of the *Cranium* into venous Bags or Pouches, from thence back again into the internal *Jugulars*, *Subclavians*, *Carot* and the *Heart*.

In the interim, this *Lympha*, as it is every where, being secreted from the Arterial Blood, in every Part of the *Cerebrum* and *Cerebellum*, like all that which hath been constantly pour'd into the *Ventricles*, returns here saith *Ridley* into the lymphatick Vessels, the *Infundibulum*, the Pituitous Gland, the jugular Veins and *Heart*; so that there is a perpetual Circulation made of it thro' the Brain.

All which being understood, will furnish us with Answers to the following Questions: Why the *Cerebrum* and *Cerebellum* with their Appendixes are supply'd or fenc'd with a bony Case or Scabbard, and what is the Benefit thereof? Why is there a Vertebral Case or Sheath given to all the *Medulla Spinalis*? Why are Muscles, Glands and Fat wanting here? Why do not the *Carotid* and *Vertebral Arteries* accompany their Veins, but are convey'd by a distinct Course, by other Holes distinct from them? Why is the Blood evacuated within the *Cranium* into *Sinusses* posited at certain Places, and why does it not go out again directly? Why do the Veins empty themselves by opposite ways into the *Sinus*? Why is the Figure of the *Cerebrum* spherical? From whence and of what Use are the *Ventricles*? What does the *Plexus Choroides* make? What Use or Benefit do we enjoy from the *Saliciformes*, and another Process of the *Dura Mater*? Why does the *Cerebellum* want *Ventricles*, is placed separate, and is safer covered than the *Cerebrum*? Why are not the soft Nerves that issue from the Substance of the *Cerebrum* and *Cerebellum* compress'd, but have a free Exit? Whether the Origin and End of all the Nerves terminate in the Pineal Gland.

If we have regard to all these Things, it is manifest we ought to adore that Wisdom that hath so form'd the Vessels here, that there may be an equal and not obstructed circulatory Motion of the secreted Humours: So that a perpetual Heat may be encourag'd, equally as well from the Arterial as Venal Blood, which otherwise would be wanting in the smallest Vessels: Lastly, That the returning *Lympha* may be commodiously convey'd and mixed with the Venous Blood, in whatsoever Situation the Head is placed.

The Blood afterwards returning from the Brain, endowed with its Energy, diluted with the cerebral *Lympha*, mixed with new *Chyle*, *Lympha* and *Bile*, pour'd in together with Spirits perhaps and venous Blood into the Veins, received by the Heart, puls'd thence into the Lungs, and chang'd farther by them, reassumes again that Nature or Disposition which it had before it reach'd the *Cerebrum*.

For if nothing that is crude will stick thereto, certainly it is most aptly fitted for every new *Apparatus*, which will supply new Spirits again from the Assistance of the Texture of the *Cerebrum* and *Cerebellum*.

Wherefore also it is probable, that a certain Portion of the whole Mass of Blood may so go and return this way, that is, shall scarcely be mix'd with Blood of another Nature, but here undergo a frequent, swift and more equal Circulation.

Lastly, If we contemplate the vast Size or Substance of the *Cerebrum* and *Cerebellum*, the *Medulla oblongata*, *Medulla spinalis*, and make a comparison with that to the rest of the Solids of the Body; the great Number of Nerves issuing there from, and distributed every where throughout the Body; the *Cerebrum* and Spinal Marrow are the *Basis* of the *Embrio*, from whence the remaining *Viscera* and other Parts are afterwards generated, as the famous *Malpighius*

pigibus witnesseth: There is scarce any Particle of the Body, which is not sensible, or that moves not it self: We may easily believe all the solid Parts of the Body are made of nervous Fibres, and consist of them.

It will not also be absurd to suppose, that the smallest Vessels in the whole Body arising from an Artery in the Extremity, comes to be like the smallest Fibril of a *Nerve*, as to Size, yet containing an Humour therein, and other Properties.

That Part or Portion of the Blood which reaches the Head, but being carried by lateral Arteries, is not bestowed in elaborating the Spirits, but is brought saith *Ridley* to the *Dura Mater*, the *Cranium*, the *Pericranium*, the Muscles and other Parts incumbent on the *Cranium*.

The *Dura Mater* is the *Basis* of the internal *Periosteum* of the *Cranium*, in which these appointed *Arteries* send forth small Branches to the very Bones of the *Cranium*, which propagate the minutest Vessels every where, but those are distributed amongst the fine, thin, osseous Plates, which running in with others constitute those subtil Unions, to which Nutrition, Heat, Secretion of Marrow, according to the occasion of the Increase or Decrease of the *Cranium* is brought about.

Hence the Blood, which from its Solidity, Thinness, Mobility and Fluidity, next equals that which is bestow'd on or given to the Head, is driven into the Subclavians, Axillaries, Brachial Arteries and those of the Hands; where likewise it performs its Actions by the minutest Vessels, as in those Parts there is the greatest Agility, Motion, Strength, Heat, Sweat, and from the same Causes the swiftest Circulation.

But as it is in other Places so likewise here, the brought Blood secreted and distributed thro' the smallest Vessels is carryed into the Bones, the Marrow, Membranes, Muscles, Fat, Glands and Skin,

where the Vessels disappearing by reason of their extream Fineness, there is a Return made by other Vessels, sensibly or by degrees increasing larger, and the Humours are brought again into the Veins of the *Hand, Arm, Shoulder, Axillary, Cava* and *Heart*.

For we must understand that at the End of every little Artery, there is placed a little Machine, as it were of a glandulous Structure, from which springs a Vessel that carries the Humour off, which is secreted there, and which is various, being lymphatick, serous, oily, and which also being brought back again in its Vessels, pour'd into the Blood and mixed therewith, returns by the Veins with the rest of the Blood into the Heart. Every *Dropsy*, especially an *Anasarca*, hath a lymphatick Humour rising in the Parts, the Veins of which being bound; you may discover *Fistulous Ulcers, Hydatides, Phlyctenæ*, frequently lodged in the Fat.

From whence that Part of the Blood, whose stronger Texture renders it more immoveable and thicker, is carried according to the *Hydraulick Laws*, as *Casseri* says, into the descending Trunk of the *Aorta*; the finer Part of which saith the same Author, enters the *Intercostal Arteries*, which performing its Office, and passing with a quick Circulation after the former, disburthens it self saith *Barthol: Eustachius* into the *Vena sine pari*, so into the *Cava*, and returns into the *Heart*, by which wonderful *Apparatus* it is brought about, that there is such a free Circumduction or Circulation of Blood, that is no ways impeded by the Quantity of Blood in the *Vena Cava*; while the Parts exonerating themselves into that Vein, to wit, the *Intercostal Parts*, and great Part of the Membranes seated in the Breast, seldom bring any Hindrance or Impediment without great and evident Danger of Life, for which Reason saith *Ruyfch*, there is a free Course from the *Arteries* into the

the Veins: Whereby is understood the Reason of its Celerity in these Passages, as also the Frequency of the most acute Diseases happening so often here.

From thence *Casseri* says, the *Pbrenick Arteries* and *Pericardia-Diaphragmaticks*, receiving the Blood equally, or alike, from the *Intercostal* and *Vertebral Artery*, and here by an absolute Course, discharging themselves into the *Pbrenick Veins*, from thence into the *Cava*, likewise make way for a free and rapid Circulation of the Humours.

A little after the descending *Aorta*, after passing by the *Septum transversum*, visits the *Loins*, the *Abdomen*, the *Thighs*, the *Legs* and *Feet*; from whence the Blood returns by the Veins furnish'd with Valves about the Inferior Parts: But from this same Trunk, here the Arterial Branches are propagated from under the *Diaphragm*, to all the *Viscera* of the *Abdomen*, which may be commodiously divided into such as contribute towards the *Chyle*, the *Urine*, and the *Sperm*, and which perform their Actions by a glandulous Structure.

The Action of the Spleen.

THE Place or Situation of the Spleen saith *Vesalius*, and its Nearness to the *Celiac Artery*, as well as its Office for that Bowel, together with the Motion of the Humours thereof, requires that we should treat of that first. It is seated in the left *Hypochondrium*, hanging under the *Diaphragm*, adhering to the left *Kidney*, the *Caul*, and here as if it were the *Ventricle*, it easily receives the Variety of Pressure, and perpetual Agitations upwards and downwards, from the Motion of the *Septum transversum*, and the *Abdominal Muscles*.

This Bowel receives pure *Arterial Blood*, immediately after it is expuls'd from the Heart, by the

first notable *Artery*, arising from under the *Septum*, to wit the *Celiac*, while the first Branch thereof saith *Lewer*, gives to this a Shoot or Sprig, and the third Branch often bestows upon it three Trunks, or some that is granted from the *Aorta* it self, for this Reason, that the *Liver*, the *Pancreas*, *Duodenum* and *Stomach* may receive theirs from the same Vessel; that the Blood so supply'd may be like to that which is bestowed upon the said Parts.

These *Arteries* according to *Drelincourt* are pretty large, and exceed those of the *Liver* by an incredible Size, the Body of which saith *Ruysch*, at its Entrance in presently distributed thro' the whole Substance, is divided into innumerable many Branches, the Ends of which pass into small Canals that are join'd together, and so collected that they seem to constitute little Glands and so disappear, every where about the Extremities of the *Splenetick Vein*.

Comparative Anatomy in Men, Oxen, Sheep, Moles &c. the morbid State in a dead Body, with putrified Tubercles swimming in the *Spleen*, the looking on a macerated or bruised *Spleen*, teach us, it is not improbable that those *Arteries* may degenerate into a glandulous Structure.

Yet when the Artificial Impletion of the Vessels according to *Ruysch*, shows us a direct Passage from these *Arteries* into the Veins; all the Ends or Extremities of the *Splenetick Arteries* do not appear for that Reason to be terminated, but to obtain here a variety sufficiently remarkable; which yet no Art can distinctly produce to the Eye, especially by reason of the extream Brittleness of that tender Bowel.

Yet it appears plain, that that is the Structure of the Parts here, which is present every where throughout the Body, where Secretion is perform'd; and therefore that is certainly done in this Place.

Yet

The Action of the Spleen.

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Yet here is no common Emunctory, saith *Drelincourt*, producible from the *Spleen*, and the Lymphaticks found there investing the entire Membrane, run only betwixt the Two Splenick Membranes; and also penetrating the interior Parts, they arise not from these Extremities of the *Arteries*, but from those Vessels which serve for the Nutrition of the Splenick Body.

Therefore since comparative Anatomy teaches, that in most Brutes the same Structure is to be found, saith *Malpighius*, which perhaps in Man is not unlike, tho' by Reason of the great Largeness of the Part, it cannot be demonstrated to the Eye; but it hath a near Resemblance; the Splenick Vein is very large as it enters the *Spleen*, stretching its Branches every where about, thro' its whole Mass; it hath *Foramina* conspicuous enough, from thence being further distributed, it seems almost out of Sight, at the Ends of the little *Arteries*, where those and the Nerves are together; whence it is plain that from the Extremities of those Vessels, and also by the *Foramina* which are sufficiently large, this Vein is fill'd; and therefore the Blood is not drawn back by the Extremities of the Venous Mouths, from that glandulous Structure; but by those larger Orifices which open into the Venous *Sinus*, and receive that Humour which can be evacuated thence out of the adjacent Receptacles.

For if the Splenick *Artery* be inflated with Air, and then the Vein be strictly tyed, that is, distributed thro' its whole permeable Body, and afterwards the *Artery*, the Spleen being cut off and dry'd in the Air, there will appear besides *Arteries*, Veins and Nerves, many empty, distended and distinct Cells, made up of erected Membranes of a different Figure and Size, which lye open mutually amongst themselves with a gaping Orifice, and also are imprinted

printed or drawn into those greater *Foramina* from the venous *Sinus*.

The Sides of the Membranes which constitute the said *Cells*, are water'd by the minutest *Arteries*, likewise the small, white, soft, innumerable *Corpuscles* of an oval Figure, dispos'd in the Membranes forming those *Cells*, are like a Cluster of Grapes which press or squeeze the Glands at every sensible Function.

In the mean while, saith *Willis*, there are many large different Nerves, stretch'd thro' the *Spleen* singly, and every where distributed thro' the same, when at the same time there scarce appears to be a sensible Motion exercis'd or perform'd in that *Viscera*, neither does there seem to be any Sense therein, or is it observ'd to have been required in it: Wherefore it is scarce credible, that those little Canals shou'd bring hither their subtil Fluid, and also mix it with other venous Liquors brought here.

From hence the first Action of the *Spleen* appears to be, that the *Arterial* Blood rich in *Lympha* and perfect, prepares in the smallest Glands a more subtil *Lympha*, which it secerns by its particular *Emunctories*, and pours out into the Cells; which is also partly sent into the *splenick Vein*. 2ly, The remaining Blood after this Action is return'd by the minute Veins; hence it seems to be cast into the common *splenick Vein*. 3ly, The other Number of little *Arteries*, which invests the Sides of the Cells, pours in an attenuated or thin Mass of Blood from their *Arterial* Structure, loaded or full of *Lympha*, opening into the Cavities of the Cells, as is observed to happen in the Cells of the virile Yard. 4ly, From thence that copious Spirit of the Nerves is suppos'd to be carried, deposited, mix'd and daily supply'd. 5ly, All those Humours thus prepared, confounded or mix'd together, stagnating for a time,
by

by the *Arterial Force* of the Blood, the *Impetus* of the nervous Juice, the Contraction of the two proper Membranes and the *Vagina*, the Constriction of the *Fibres* so numerous here, the Agitation of the *Septum transversum*, the Muscles, Vessels and *Viscera* of the *Abdomen*, are compress'd, mixed, attenuated, and undergo the same Operations as the Blood does in passing thro' the *Lungs*.

For which Reasons, this Fluid, free Blood, being full of Spirits and abounding with *Lympha*, is difficult to concrete, being intimately mixed, not easily dividing into Heterogeneous Parts, but is made of a purple red Colour, and such as is sent forth from this Bowel by the great *splenic Vein*.

This therefore is the Effect or Action of the *Spleen*; and consequently it hath no *Emissary* as the other *Viscera* have; by which it emits a particular Humour made from its own Structure, but produces all mixed together.

Indeed it appears most evident, that all the Fruit of this Action arises in the *Spleen*, but is of no Service thereto; but since every Humour thus made passes into one of the Veins of the *Porta* and *Liver*; it is plain the Use of the *Spleen* is to assist the *Liver*, and therefore cannot be conveniently explain'd, except first we examine into the Effects and Functions of the *Liver*.

But there are many things otherwise obscure enough to be understood from the Doctrine laid down, and from thence may be confirm'd or proved, as for example.

What does the Situation, Substance, Neighbourhood and Suspension of the *Spleen* signify?

What do we learn from the Position, Origin and Size of the *Splenic Artery*?

Why the Animal, when the *Spleen* is taken away, remains salacious alone, and how long? The Situation of the *Spermatick Artery* learns us that.

Why

Why a frequent Inclination to make Water follows the cutting out of the *Spleen*? The *Renal Artery* informs us.

Whence proceeds the great Voraciousness to an Animal after the Loss of the *Spleen*? The Situation of the *Celiac Artery* indicates that.

What is the Reason in the first Days of Vomiting and Nauseousness after the Extirpation of a *Borborismus*? The same as the former, together with the Position of the Nerves of the Stomach and *Spleen*.

Why is there a Swelling of the Right *Hypochondria*, and an Encrease of the *Liver*, after the Loss of the *Spleen*?

What is the reason that splenetick and Hypochondriack Patients are so subject to be of a pale or wan Complexion?

What can be the Cause why they are so prone to Laughter?

Therefore whether the *Spleen* be made for a Ballance of Weight on that side, or for Symmetry and Proportion? or whether it is an useless *Pondus*? or the Error of sleeping Nature? or the Sink and Channel purging melancholy Dregs from the Blood? or it is the Operator and *Focus* of the vital Spirit, by the radiant Heat of which the Action of the Stomach is animated and encourag'd? or this be the Seat of Luxury, the kind Author of Fecundity, or the niggard Step-mother of Barrenness? whether here lies hid the soft Promoter and Nourisher of pleasing Dreams? or it may be rightly term'd the antient Parent of Laughter, Mirth, Joy and the *Saturnian* Age? undoubtedly all these things are clear'd up, by the evident Discoveries of the accurate *Malpighius*; nor is it made more probable to support the Nerves dilated hither, and made to distribute the Spirits thro' its whole Region; neither can it give less than universal Perfection to all the Blood.

The Action of the Omentum or Caul.

BUT while that Blood is prepared from every Part of the *Spleen*, saith *Vesalins*, thro' several venous Ducts, it is at length poured into the great *Splenick Vein*, as from its Duct it is thrown into the *Vena Porta*, and from thence into the *Liver*; in all this Course the venous Blood from the *Caul*, is mix'd with it by its own proper Vessel, agreeable to the settled Law of Nature.

The Connexion, Situation, Structure and Insertion of the *Caul*, consider'd by the illustrious *Malpighius*, and confer'd together with those which that industrious Anatomist hath detected in the different Bodies of Brutes; teacheth us the same from the omentous *Arteries*, distributed about the little Bags or Cells of Fat, into fine reticular or Net-work Unions, and there ending in Veins placed in like manner there, which by the Help of lateral *Emissaries* betwixt the Bags of Fat, discern or separate a thin subtil Oil from the Blood, which they there collect and keep; so that at last from these Bags united together, and opening into certain Ducts, this collected Oil is expell'd, and so may be conveyed forward to the *Liver*, and by the same reason pour'd in, and mix'd with the *splenick Blood*.

It likewise appears probable from the Apertures of the minutest Vessels, lying open every where in the Superficies of the *Caul*, that there is insinuated into them a fine Vapour, that arises constantly in the warm Belly, from a subtil Dew dropping there, thro' the small Mouths of the exhaling Vessels; whereby they are always found and observed to be hot, and to moisten the Superficies of all the Bodies, adhering to or within the *Peritonæum*. But it is necessary, that this subtil and somewhat volatile Humour shou'd be allowed; for we are made sensible

sible thereof from its Rise, Nature and Odour, that diffuses or spreads it self upon the opening of the *Abdomen*, besides the perpetual Consumption and Refection of the same.

Since therefore the *Caul* is not observed or taken notice of, to have any other excretory Vessel in Man, besides the Two Veins, call'd *Vesalius's* right and left *Epiplack*, it is probable the venous Blood of the *Caul*, enrich'd with *Lympha* and Oil, pours it all out to be mix'd with the flowing Stream in the *Liver*.

From whence may be understood, why in Creatures at rest, the Substance of the *Caul* should grow to such a Bulk? and why on the contrary, in Animals that use too much Motion, the Vessels shou'd rather appear full of *Serum*, than Fat or Oil? Also why in emaciated and Hydropick Bodies, these Vessels are almost always fill'd with a thin *Serum*? Lastly, that for the Encrease of Motion there is required a greater quantity of collected Oil, being derived towards the *splenick Vein*, and at length the *Caul* adhering to the *Viscera* that are almost void of any Fat.

But to the same Blood also, that venous Part is mixed, which returns from the Texture of the *Ventricle* by *Vesalius's Vas breve*, the left *Gastro-epiploick*, the great *Gastrick*, the right *Gastro-epiploick*, and the *Pylorick*; which being destitute of that, distills into the Cavity of the *Ventricle*, therefore is mixed in divers Places to the returning Blood from the *Caul*; and perhaps carries with it a great deal of the subtil Humour, which it drew from the finer Part of the Aliment; either Eatables or Drinkables by the absorbing Vessels of the Stomach.

But the smallest Branches from the *Pancreas*, and the internal *Hæmorrhoidal*, from thence also draw their Blood, which perhaps is a little more acrid than the rest.

Lastly,

The Action of the Liver.

Lastly, All the Blood which was brought into the *Mesentery* and *Intestines*, by the Help or Assistance of the upper and lower *Mesenterick Artery*, and there exercised, returns into the *Mesenterick Veins*, and at length is mixed with all these Humours before its Entrance into the *Liver*: And this last wants the Conveyance of *Lympha* into the Cavity of the *Intestines*; but being again furnished with a thin *Bile* and some Part of the *Chyle*, it affords Matter that is not altogether useless for making *Bile* for the *Liver*.

Therefore the Blood, which presently flows by the *Vena Porta* into the *Liver*, is fluid, soluble, attenuated with Spirits and *Lympha*, rich in *Bile*, and partly by the Help of Respiration acting powerfully thereon, partly likewise by the Force, tho' more gentle of the Blood puls'd round it, all these different Humours brought from different Parts, are well mixed in the great Channel, into which they run together, that they may be fitter for Transfluxion, Secretion, and thorough Passage into the Veins.

The Action of the Liver.

THE *Vena Porta*, saith *Vesalius*, form'd out of so many Veins passing here into this one Tube, elated upwards, enters the *Liver* about the middle of the hollow of the Superficies betwixt the *Tubercles* call'd *πύλας*; a little further becomes strong and fibrous like the Tunicle of an *Artery*, with a Coat as a Sheath, forming a Space half an Inch broad, making a *Sinus* sufficiently large and ample, being driven into which, it is collected and retarded there, this various Humour from the proper Motion of its Concourse and the Action of Respiration, is subdued and mingled, so that being equally divided, it proceeds on its Course.

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Presently after it issues forth after the Nature of a Vein and a *Sinus*, and being, according to *Glisson*, dispers'd into many Branches, and from thence into innumerable lesser ones, it reaches almost every minute Point of the Hepatick Body, so that at last its Extremities escape our Eyes, and so constitute every Part of the whole Substance of the *Liver*.

Thence the Hepatick *Artery* arising from the right Branch of the *Celiac* *Artery*, entring the *Liver* near the *porta*, it insinuates it self into the Substance of the *Vagina*, being distributed thereby, and divided even to the minutest Parts, it reaches all, or the smallest Places, and so is seen not only in the *Tunicle*, but in every Part, tho' it passes not thro' this thick *Vagina*, and so cannot penetrate the larger Vessels. Hence others, saith *Ruyssch*, come from the *Diaphragm* and the suspensory Ligament, inserting themselves first of all with their Branches; lastly, their Extremities are from the *Cystick Arteries*.

But the *Vena Cava*, saith *Vesalius*, tending upwards towards the *Diaphragm*, insinuates it self by the Gibbous or *Convex* Superficies, in the Place of its Connexion by open Passages into it self, and distinct *Foramina*, receives from the *Liver* three larger Branches, and several lesser ones; which, saith *Glisson*, being collected from innumerable small ones dispers'd thro' the whole Body of the *Liver*, at length bring back the Blood from the *Vena Porta*, tho', saith *Ruyssch*, they seem to be fewer in Number, and less in Size than the other.

Where-ever the last or extreme Ends of the two said Veins are joyn'd together, they become so small, that being disposed into an admirable fine Bundle, like so many Hairs tyed together; and being thus configurated, they appear, as *Malpighius* demonstrates, like distinct Globules, arising from close invisible Vessels, separated from the neighbouring ones; these

The Action of the Liver

these Corpuseles are likest those which are call'd simple Glands; to be the better satisfied in which, we must apply our selves to the Inspection of Insects, Fishes, Quadrupeds and Birds, and be convinc'd from the naked Eye.

In which very Places, there is always found a little small Canal, arising from those Kernels by an invisible Spring following the Branches of the *Porta*, with an undivided Course wrapt up in the same *Vagina*, and sticking to it, as *Ruyssch* affirms, so tenaciously, that it cannot be separated, growing by degrees from the Concourse of the like Pipes, ending at last at the Trunk of the *Vena Porta* in one Pipe, according to *Glisson*, which is call'd the Hepatick or Biliary Duct, whereby a various or different Fluid is assiduously received and deduced thence, call'd the Hepatick *Bile*.

The Contemplation of the Fabrick or Structure of the *Vena Porta*, the *Cava* and Hepatick Duct; the Consideration of the Motion of the Humours work'd in the *Vena Porta*; the Nature of the Humour contain'd in the Biliary Duct; Anatomical Experiments made by binding or tying, cutting and collecting the *Bile* teach us, that from the Blood brought by the *Vena Porta*, there is a fluent Humour separated in those minute Places, which is afterwards thrown out of the *Liver* by the little Branches of the Hepatick Duct, while the remaining Blood by this Labour, impuls'd from the Branches of the *Vena Cava*, out of the *Liver*, flows thro' the *Vena Cava* towards the Heart.

Which thing is clearer understood from the Distribution of the Hepatick Nerve, divided always the same way as the *Vena Porta*.

In Men, the capacious oval Gall-bladder adheres to the hollow or concave Part of the *Liver*, saith *Vesalius*, passing out into a Cystick Canal or Duct, so that the Neck is deeper than the bottom, from

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whence,

whence, with the *Porus Biliaris*, it is join'd to its own Duct, by an acute Angle, making thus united together, the great common Duct obliquely descending, which, apply'd to the acute Angles, penetrates the exterior Coat in the *Duodenum*; from thence, descending betwixt that and the other, proceeding forward with this Perforation, with a long Course betwixt the second and third, it makes a free Exit by a round *Foramen* into the Cavity of the *Intestine*; all which teach us, that the *Bile* cannot at all times and in every Circumstance, be pour'd into the Guts from the *Liver*, but only when the *Intestines* are relaxed, for upon their forcible Contraction it is not to be done at all.

The Hydraulick Contemplation of this Fabrick, compared with what hath been already delivered, demonstrates clearly, that from every point of the *Liver* and the Gall-bladder, there is an Humour brought by the common *Meatus* or Passage, thro' a natural Course or way into the *Intestines*, where being puls'd from the Ventricle, the *Chyle* is first of all lodg'd.

In the mean time, Experiments teach us, that the way is open and ready from the Cavity of the *Gall-bladder* into the *Liver*, the Biliary Duct, the *Intestines*, likewise from the Hepatick Duct by the *Liver* into the *Gall-bladder*, the Cystick Duct, the *Intestines*, and lastly, from the Hepatick Duct into the Cystick, from this into that: Anatomy informs that the *Vesicula* is sometimes wanting in Horses, as *Needham* affirms; otherwise, according to *Wepfer*, the Hepatick *Meatus* pours in its Humour from the Cavity of the Bladder; sometimes the Hepatick *Bile* does it visibly from the *Vesicaria*; from whence it is very probable; first, That the Hepatick *Bile* naturally runs backwards and forwards, sometimes into the *Bladder*, sometimes back again into the *Liver* and *Vena Cava*, from thence it flows thro' the Body:

Body : In the next place by stagnating in the *Bladder*, it acquires the Property of the *Cystick Bile*. 3ly, But perhaps the bitter Part or Portion is chiefly made in the Glands, seated in the Membrane of the *Bladder*, water'd by the *Cystick Arteries*, as in the Membrane of the *Auditory Meatus*; and then 4ly, From thence to mingle the refluxent *Hepatick Humour* in the *Bladder* it self.

Which are more confirm'd by the Discoveries of *Glisson*, *Verbeeyen* and *Perault*, from the numerous Pipes out of the *Liver* and *Hepatick Duct*, implanted into the *Gall-bladder*, perpetually carrying an Humour from thence.

From all which Authors, the Truth will shine by their Determinations of the following Positions: First, That the *Hepatick Artery* serves for the Support of Life, Nutrition, Heat, Propulsion of the *Hepatick Humours*, the Secretion and Expulsion of the same. 2ly, That from its Extremities are produced the vast quantity of invisible *Lymphaticks*, from whence come the visible ones, which end not in the *Vena Porta*, but in the Cystern of the *Lumbares*. 3ly, There are Veins receiving Blood brought from the *Hepatick Artery*, that remains after this Operation, conveying that into a Portion of the *Azygos Vein*, which is under the *Septum*. 4ly, All the *Abdominal Viscera* are serviceable, or contribute to Digestion, the *Spleen*, the *Caul*, the *Stomach*, *Pancreas*, *Mesentery*, *Intestines*, being useful to the *Liver* only by carrying thither a venous Blood, but what is wonderfully chang'd or alter'd. 5ly, The Veins may be chang'd into Vessels the likest *Arteries*, from their Structure, Size and Use. 6ly, The Secretions are made from the venous Blood. 7ly, The Portion of the Blood from the Heart, is made from a double arterial and a double venous Pulse, before it returns into the Heart. 8ly, The Trajection of the Humour is slowest here; and therefore, 9ly, The

Connexion and Situation of the *Liver* to the *Septum transversum* is necessary. 10ly, The Generation of Stones, Gravel, Worms and other *Sordes*, is more easy in those who use little Exercise about this Bowel, from whence proceeds many Diseases. 11ly, The entire Office or Function of the *Spleen*, is to prepare *Bile* for the *Liver*. From whence, 12ly, there is such a Dependence on one another, as well in Health as Sickness, and in every circumstance of Life. 13ly, The matter or substance of the *Bile*, as Chymical *Analysis* informs us, hath here a different Original from the rest of the Humours. 14ly, There is here a singular or particular Circumduction of the Blood, the like to which is not to be discovered any where in the Body. 15ly, There is a certain Likeness betwixt the *Sinus* of the *Vena Porta* and the Heart, betwixt the Five Branches of this *Sinus*, and the *Arteries* springing from the Cavities of the Heart. 16ly, There is not elsewhere to be met with a greater Difficulty in the Cure of Topical Diseases. 17ly, Notwithstanding, there is no where so many *Viscera*, so many Vessels, Humours and Causes, that concur to create any Liquor or Fluid in the Body, as do, to produce the *Bile* in this place. 18ly, Hence this must be the most useful, universal, efficacious Help or Assistant to the Change or Alteration of a foreign and exotick Humour into the nature of a familiar Inmate: therefore, 19ly, The *Bile* is not an Excrement, but in the last Place the *Liver* rather serves to promote *Digestion*, than *Chylification*.

The Action of the Kidneys.

Since we have already treated of the *Pancreas*, *Mesentery*, Stomach and Intestines, Order requires that we shou'd proceed to the Action of the *Kidneys*:
 Their

Their Situation and Connexion are so order'd, that they may be assisted in Excretion by the Motion of the neighbouring Parts, especially the right *Kidney*, saith *Eustachius*, being defended under the Membrane of the *Peritonæum* expanded round it, and wrapt up in a drier kind of Fat, they receive, saith the same Author, incumbent Glands; and from thence, out of the descending *Aorta*, a large Branch or more, from thence Four or Five larger ones, from these, many other less; and then again, the smallest crooked ones that escape our sight, being distributed thro' all Parts of the *Kidneys*. Those Branches of these little *Arteries*, saith *Ruyfch*, being united and separated in their mutual Courses, form as it were a *Clue*; but from these last, there seem to arise the minutest returning Veins, as well as lateral Pipes, that are very fine and almost pellucid, receiving and conveying the Urine separated from the little *Arteries*, and where they are united, they form many pyramidal polygon Bodies, that at length end, say *Malpighius* and *Bellinus*, oftentimes in twelve membranous Bodies, call'd *Papillæ*, in which many collected Mouths of the renal Pipes stand open obliquely, every where and on every side as well without as within.

In the mean time, there are, according both to *Malpighius* and *Ruyfch*, small, round, hollow Corpuscles in the Substance of the *Kidneys*, adorn'd on every side with little Vessels, made up of Veins and Nerves, almost touching the urinary Pipes; whence the Urine may be seen to be secern'd or separated here, by a double *Apparatus*, from a glandulous Operation, and that more simple one of *Ruyfch*, which is not repugnant to the Practice of Life in Nature in other Places, as for example, in the *Liver*.

But the other Part of the *Renal Artery*, is necessarily bestow'd for the Support of Life and Heat, by being subservient to the very substance of the

Kidney: And from the Blood of this, *Nuck* says, that *Lympha* seems to arise, which returning in such abundance from the *Kidneys*, is restored by the Channel of the *Chyle*, into the great Circuit of the Blood: And without doubt all its proper Veins spring from hence.

For from the extreme Sprigs of the little renal *Arteries*, the smallest Veins arise, saith *Eustachius*, which being gather'd together make greater, unite into Branches like the Division of *Arteries*; at length, saith he, joyning again, their Trunks, are uncertain in Number, and emit by different ways into the *Vena Cava* Blood, that remains after the performing their Functions.

Besides, the *Papillæ* of the *Kidneys*, the Fluid brought by the urinary Pipes, drop into a large Cavity, made from the expanded Membrane of the *Pelvis*; from whence the collected Mixture is driven into a Duct made by the streightned *Pelvis*, call'd the *Ureter*, from whence it is carry'd afterwards to the Bladder.

For from the Circuit or Course of the *Papillæ* arise, saith *Eustachius*, Eleven or Twelve membranous Canals receiving them and the Humour distilling there-from, which pass into Three great Branches, that being collected into one, make a large *Pelvis*; which ends in one strong membranous Pipe, made up of *Arteries*, Veins, Nerves, Lymphatick Vessels and moving Fibres, that is call'd the *Ureter*, which running downwards, afterwards bending in, under the *Lamella* of the *Peritonæum*, it is inserted, according to *Vesalius*, in the postick Part of the Bladder, scarce Two Fingers distance from the lower Neck, and perforating the external Tunicle or Coat far less than the space of a Finger's Breadth, runs obliquely betwixt this and the internal, and makes a Penetration into the Cavity of the Bladder, where

The Action of the Urinary Bladder.

where it pours in the renal Urine by a safe Journey, being hindred by its own Structure or Make, from rising back from the hollow of the Bladder into the *Ureters*, howsoever it be compress'd or squeez'd.

Microscopes, Injections, Ligatures, comparative Anatomy in Hedgehogs, Mice, testaceous Fish, Bears, Oxen, Birds, Human *Fetui's*, the Dissection of Dead Bodies, subject to Diseases of the Reins, monstrous Kidneys, all these teach us this is their Condition.

From whence a mechanical Secretion of Urine is understood to be made by the Force of the adjacent Heart, and the Strength of the Arteries, by which the aqueous Blood is push'd forwards thro' innumerable Windings and Turnings, opposite Motions, Concussions, &c. and last of all, its liquider Part is secern'd, propell'd and ejected by much straiter or narrower Pipes, than those of the sanguiferous Vessels.

Therefore here is no feigning of Attraction, Emulsion or the like Faculties, neither will there be any need of a foreign or intestine Fermentation; for here is neither Place, nor Cause, nor Time, nor Matter, nor Mixture, nor Effect; neither ought we further, for the same reasons to imagine any Virtue or Function of pouring out, or precipitating the Liquor, but that it flows naturally or of its own accord, according to the Size, Structure or Strength of the renal Vessels.

The Action of the Urinary Bladder.

IN the *Pelvis*, beneath the over-stretch'd *Lamella* of the *Peritonæum*, adheres the Urinary Bladder, saith *Vesalius*, securely defended, consisting of three different Membranes, to wit, of an external one

104. *The Action of the Urinary Bladder.*

from the *Peritonæum*, a middle one made up of various muscular Fibres, and an internal Membrane, saith *Graef*, form'd of mucous Glands, which hinders the Erosion of the acrid Urine that may lodge thereon. Therefore when the Urine corrodes, distends or irritates by its Acrimony, Quantity or long Residence upon the Part, a troublesome Sense of Pain arises from the detens'd *Mucus*, or Slime being worn off, by which means the Motion is excited; from whence all the Abdominal Contents are driven with great Force into the Membrane extended over the *Pelvis*, hence into the Bladder, and since nothing resists at that time, the Urine is driven beneath with great Force into the Aperture, at the Neck of the Bladder; extending it, and pressing the Vessels placed around it, it raises the orbicular Sphincter, which, according to *Fallopins*, sticks in the upper Part of the Neck above the *Prostata*, under the right external Fibres, with their transverse carnosus ones that are not very thick; from whence, by the same Force, *de Graef* asserts, the Urine is driven into the hollow Pipe of the *Urethra*; and then by the flaccid *Urethra*, from hence, out of the Body.

As soon as that Action ceases, the Fibres pressing no further, contract themselves by the proper Strength of the Sphincter, and so firmly shut the Bladder: So the Muscles in Men, expressing and agitating the Urine, expel the Remainder thereof: For since these, saith *Cowper*, arise from the upper external Part of the *Urethra* under the *Os Pubis*, and bind or surround extrinsically part of the same *Urethra*, united on the lower side, and so proceeding to the *Peritonæum*, and there ascending separately, are inserted on both sides to the *Corpora cavernosa* of the *Penis*: This Action of those is easily understood, for being lost in old Age, there is a troublesome *Stillicidium* or Pissing drop by drop attends that Evacuation.

But

But the Urine is of many kinds, as we may distinguish at first before we say any thing of its Nature; for from a copious aqueous Drink, is made a crude, plentiful, soft, insipid Water, without Smell, and which may be easily kept or retain'd in the Body.

But that which is render'd from the *Chyle* already made, is more concocted and less in quantity, acrid, salt, smelling a little, and more irritating; that again, which from *Chyle* is made into *serum*, is redder, more digested, much less salter, fatid, acrid, and more stimulating, and consequently cannot be long retain'd.

But that at length, which ariseth after a continual Abstinence, by the strong and daily Attrition of the Humours, as also from the deterfed solid Parts, is at last very little in Quantity, very sharp, salt, fatid and red, being scarce able to be held at all, and approaches next to Corruption.

Therefore the Urine is form'd of that watery Part of the Blood, which contains the sharpest, subtilest and most volatile Salt, next to an Alcaline; the most acrid, thin, volatile Oil, and a fine, volatile, impalpable or subtil ground Earth.

Yet in the Water of Urine, there is a subtil, foetid, strong stinking Oil so attenuated, that it is capable of being intimately mix'd with Water, but is difficultly separated.

The Native Soap like Salt, that is analogous to that of *Sal Armoniac*, yet that is different from it, but there is a fix'd Salt first of all present in Urine, that is taken from a *Marine Salt*; therefore an urinous Salt is not acid, or Alcaline, or Armoniac, or Muriatic, but is endowed with a peculiar Disposition or Nature proper to it self.

The Oil of Urine, attenuated from the Attrition or Grinding of Fat, seems to be one simple Body, different from all others; tho' by the Mixture of Salt

Salt and Earth in it, it seems first of all to be of a various and manifold Nature.

Lastly, The Earth thereof is so thin or fine, and appears so intermixed with the rest, that hiding it self amongst the first, it is plainly undiscoverable, but separated from them, it is simple without Smell, undissolvable, white and fix'd.

Neither is there any Nutritive, wrought *serum*, or good *Chyle*, or Milk ever to be found; and whence is that hinder'd, but either by the Grossness or Fineness of those Fluids, and the Windings and Turnings of the Uriniferous Canals.

Neither is ever that necessary or requisite in Health, that is thicker or grosser in the Blood; its *serum*, *Chyle* or Milk. Hence Diuretick Waters, especially those mix'd with Salts; but before all, if they are drank cold: Fermenting Liquors are less Diuretick, and those which are oily or fatty least of all; but Acid Wines pass quick by Urine.

Hence we know how to answer these Things, from whence comes the Quantity, Colour, Smell, Taste, Thickness, and Contents of Urine, as what swims at top and what subsides? Namely from the great Variety of different Waters, Spirit, Oil, Salt and Earth, entering into the Mixture of the Urine. Therefore whether the Separation of it thro' the Kidneys, be necessary to the Preservation of Health, or it can be supply'd from other substituted Excretions, we have an Answer.

Therefore since the Motion of the Humours, the Fabrick of the Body, Ligatures, Injections, Autopsy, Diseases, arising from the Interception of Urine, teach us clearly how commodiously it issues from the Blood by these Passages only: Therefore what need is there of feigning or imagining in the Stomach and Intestines, Passages or Holes from their Cavities, that send forth an Humour or Liquor into the Cavity of the *Peritonæum*? From thence again
in

in the Membrane extended over the *Pelvis*, and wound about the Bladder, as also in the Body of the Bladder, that there are such like Pores every where, which absorbing an Humour from the hollow of the *Peritonæum*, directly convey it into the hollow of the Bladder? Again, there is no *Remora* or Obstacle that resists that inward Propulsion, but a ready and most expeditious Round. Last of all, what need we feign *Phænomena*, when indeed there are none to be observed that enforce it, no Arguments that can prove it.

But if we enquire whether it is probable, that the Kidneys contribute any thing to the *Semen*, and what that is? Undoubtedly the Situation of the Emulgent and Spermatick Artery, will inform us something of that; and why Stones and Gravel so frequently proceed from the Urine?

The Action of the Muscles.

After seeing what is done with the Blood, agitated or mov'd thro' the *Viscera*, it will be more easie to understand the Inquiry into that, which is driven by the Muscles into every Part of the Body, and from thence into that which is moved in the Integuments, encompassing the external Superficies of the Body or the internal Cavity.

But there is scarce elsewhere, any greater Obscurity in the minutest Vessels and Instruments, that effects the highest Diversity of Opinions, and also the Difficulty of the best Choice.

For the solid Parts of the human Body are either moved by the Agitation of the Humour, that flows thro' them with force; or they are moved by the Help and Assistance of the Muscle, that is fasten'd or bound to them; but that being disunited, cut under,

unfunder, or corrupted, this latter Motion ceaseth ; but this Motion is voluntary, spontaneous or mixed.

All Muscles act or move, when render'd shorter, contracting or drawing together their annex'd Solids, or they compress, or else expell their Humours by Compression. Wherefore all the Difficulty lies in this, that the Fabrick or Structure of a Muscle be assign'd, and its contracting Cause, whereof one certainly much depends on the other.

Every simple Muscle yet known, saith *Lower de corde*, consists one way of a carneous or fleshy Belly and one Tendon, which may be again divided into others very like them, but always less ; and those again which arise or spring from these into lesser ones are always like the largest ; and indeed this Division proceeds so far, that at length they vanish into such an incredible Fineness, saith *Leeuwenhoeck*, that they exceed all the Strength of Imagination ; but Reason determines them so far, as at last to bring them to a point or end ; and that very Extremity is so like to an entire Muscle, that it hath its Belly and Tendon as evident as the biggest ; but is call'd a Muscular Fibre, the Conjunction or Unions of which may properly be called a Muscle.

From these Things it is evident, that these Fibres are not Arterial, Venous or Lymphatick Vessels ; but of another Nature, and the Organs much less than these, whether vesicular, or made by one Tract or Continuation.

Since therefore it is suppos'd the Nerves enter into every Muscle, together with its Arteries and Veins ; from thence they are distributed, being deposited there by an external Case or Covering, thro' every Muscular Body, that there cannot be a Point assign'd in which Part of them are not to be found ; then that all the Nerves disappear, or are not to be seen here ; that in other Parts of the Body the Extremities of the Nerves pass as it were into explicate Nerves ;

Nerves ; from whence it is concluded that these Fibres having from the reason of the Thing, the Nature of a Nerve, from the Extremity thereof stript of its Covering, admit of the finest Expansion within the Cavity, of the Figure of a Muscle full of Spirits, which is bestowed from that Nerve, that springs from the *Cerebrum* and *Cerebellum*, continually by the Impulse of the Heart.

From these Fibres united together, are made *Fasciculi* or *Bundles*, which again have a singular Membrane, in which they are involv'd, and separated distinct from others, but that is as far as the Sense penetrates. This fine Membrane is cellulous, within full of Oil, which is bestow'd upon the Increase of such Animals as are at rest, serving to defend, anoint and lubricate the Fibres, supply'd from the Arteries, as an Injection of *Mercury* informs us.

But the *Artery* agreeable to *Ruyfch*, is brought to the Muscles, which is discover'd in the same Place, in that Size and Contexture, that the unwary would judge the whole Body of the Muscle scarcely blown up from this alone. These first of all are distributed amongst the *Fasciculi*, and in the Membrane distinguishing them, and perhaps in the external Superficies of some one Fibril ; where they end in reticular *Plexus's*, oleous Secretories, the smallest Lymphaticks saith *Nuck*, and sometimes into hollow Fibrils, like Nerves ; which Fibrils also may end either in the Cavities of a nervous muscular Fibre, or else themselves make such like.

At last it is plain that every Branch from the *Arteries* in the Muscle, hath a Vein answering to it self, which united to another makes a larger ; from whence the sanguiferous Veins of the Muscles and the Lymphaticks are made.

But the Tendon of a Muscle duly examined, is divided into so many Fibrils, as the Muscle it self, for this reason, that the Cavity of the Muscular Fibre,

Fibre becoming thinner, from its obtuse Amplitude growing into one acute Body, is made stronger, harder, dryer and narrower, being almost destitute of Vessels; from the compact Union of which the whole Tendon is made, hence call'd by the best Name *Aponeurosis*; tho' from another Opinion, from two such Muscles connected by an opposite or contrary Situation, saith *Lower* almost all the visible Muscles are made.

Therefore the Redness of every Muscle changes its Colour from the Blood by which it is wash'd; but the Substance first of all depends on the Repletion of the Arteries, Veins, oleous Cells, and Lymphatics: Hence it becomes diminished in old Age, Leanness, *Atrophia*, continual Sweatings or Colliquations; and yet Motion remains in all these, Insects also teach us, they can exercise or perform Motion, tho' not with red Muscles, because in them there appears no Flesh to the Eye.

Fibres, Fasciculi, Arteries and a *Nerve*, in Life and Death are drawn asunder, or divisible without breaking; and tho' they are tense, they are endowed with a contractile force, being cut, they shorten much, and then lessen in Substance, contracting themselves as it were into an undulating Superficies, expelling their proper Juices; hence they are always and every where in a violent State, they always endeavour Resistance in their Elongation, and labour to shorten themselves more in Life, and less in Death, therefore require an *Antagonist*.

Being strongly compress'd, evidently contus'd, totally obstructed, separated or cut off from the *Cerebrum*, the voluntary Action of all the Muscles, all Sense and Memory ceases; but the Spontaneous Action of the Muscles remains in the Heart, Respiration, the *Viscera*, and Vital Part, from a free, open, and sound Brain.

The same Things being done in the *Cerebellum*, the Action of the Heart, Respiration and Life it self presently ceases, and the voluntary Spring together with every Sense, but Motion may continue yet longer, being as it were vermicular, in the Stomach, Intestines, and ending there yet may be restored.

By the Compression, Ligature, Corruption or cutting off the Nervous Muscle, all vital and voluntary Motion perisheth intirely in it; and if the Nervous Trunk thus suffers, whose Branches are given or distributed to various Muscles, the same thing happens to them all.

From the Performance of the same Facts in any Part of the *Medulla Spinalis*, the Action of all the Muscles perish, whose Nerves under the Place affected, spring from the *Medulla*; and so the contrary; the same Experiment in the Artery, distributed to one or more Muscles, answers the same Test.

The Tendon of an acting Muscle saith *Lower*, is scarce alter'd to your Sense, the Flesh is shortned, hardens, changes colour, swells, bunches out, the Tendons approach each other by turns; the Part annex'd with the Tendons is lead toward that, which being less moveable is knit to the Tendon: This Action is call'd the Contraction of a Muscle.

In the same Tendon of a Muscle not in Action, the Flesh is longer, softer, redder, flat and subsiding; this State or Condition is call'd the Restitution of the Muscle, altho' it is almost done by the Strength of the Antagonist; for from that weight made, the Contraction remains spontaneously in the other, not from the æquilibrated but prevailing force or spring of this.

One Antagonist, acting and the other not, is as the bending of a Joint or Limb, but if both move together it remains motionless; if neither act 'tis indifferent, as it is moved by that, whereby the least
Excess

Excess of either leads, whether made by Addition or Subtraction.

But these Changes are made by turns in the minutest moment of time, and throughout the whole fleshy Part of the entire Muscle, and therefore may be absent or present reciprocally, yet leave no Tracings or Footsteps thereof in the Body.

Any warm Liquid being injected into the Artery of a Muscle, that is not in Action, tho' of a dead Person, makes or raises the Contraction thereof; notwithstanding this be tryed sometime after Death.

The Substance of a contracted Muscle appears rather encreased, than lessen'd in every Experiment.

By the external force of a bent Joynt, tho' by the Endeavours of the Will, the bending Muscle alter the acting State in the very Flexure of this Contraction; and if it had been agitated by a proper Motion, yet it had been scarce so powerful.

Nothing being determined from the Will, all the voluntary Motions are equally fill'd and mov'd in all their Vessels, from the Blood and Spirits, being equally moved by them, and that together thro' the whole Body.

From which certain explor'd *Phænomena*, the Properties of the latent Cause are evident, and the Muscles of the moving Cause, to wit,

First, It may be absent and present in the Muscle.

And therefore Secondly, To enter in and go out thereof.

Thirdly, To be derived otherways into that, otherways out of it.

Fourthly, And that in a twinkling, or rather the very moment of the Will's Efficacy.

Fifthly, And in the very moment of time, in which the Muscle is contracted, internally to push forwards, to every point of the Superficies of the Muscular

The Action of the Muscles.

Muscular *Villus*, or hairy Nap of the Skin, as also into the contrary Parts.

That is Sixthly, It ought to be equally distributed together, thro' all the Flesh of the Muscle.

Seventhly, Therefore to dilate and fill the Membranes of the Fibres; change them from an oblong Figure into a rounder, increase the lesser Diameter, and lessen the greater, and to apply the Tendons alternately to each other.

Eighthly, Lastly, It ought to arise from the *Cerebrum*, the *Cerebellum*, and the Origin of the Nerves, and may overcome those Resistances, which seem here sufficiently forcible.

Ninthly, To conclude therefore, the most fluid, subtillest, swiftest Body is required, being apply'd with Strength or Energy in the Muscle.

Which requisites, are to be found in the nervous Liquor and in nothing else; and therefore this must be own'd or acknowledg'd for a real Cause; neither is its Action difficult to be understood.

For it must be granted or laid down as a Fundamental, that the Spirits flow swifter, from whatever Cause they proceed, from the first Origin of one Nerve, than by the rest; that more run or enter into a Fibre open to this Nerve, and therefore that this will be more dilated; will send forth the strength of its Spring at the same time, be passive and active; and the same Cause continuing much more will happen, therefore it will grow wholly turgid in the shortest, and the same Determination remaining, will last contracted; which as long as it happens in infinite Fibrils together, as to Sense, the whole Muscle is in the same Condition.

It necessary follows from this Celerity encreased in one Nerve, the others are moved much less, and therefore these being relaxed, perform the Encrease with more Excess of Strength in the Contraction.

From which two Causes, all the Fibres swelling from the great force of the Muscle, bind close the Intervals placed betwixt them, and the Blood Vessels seated there; from whence the Veins are evacuated, the Arteries compress or squeeze the thicker Parts, that is, they repel the red Blood, and from the subtil force of the Heart and its own, drive them into the minutest Canals; and so from the expelled Blood, we see the whole Body of the Muscle moved, by the subtil Humour running together, thro' the Nerves and Arteries; which is manifest to every Body's Satisfaction: For that is drawn, which is affixed to the prolonged Tendon, if so be it resists less the contractile force, howsoever with the least Excess.

But this Cause ceasing, the Elasticity of the Fibres, the equal force of others, the circumposited Parts acted beyond their Tone, from that contracted Muscle, restore together an *Aequilibrium* in all Parts. Therefore in every *Phænomenon*, and every Requisite, this is made plain, from understanding the Structure and its Cause, here plainly present in the Body: But only an assumed Power in the Origin of the Nerve encreases its Celerity; that being common to every *Hypothesis*, neither can this be explain'd.

Therefore *Galen's* incorporeal Faculty inflating the Nerves, is of no Service; nor the nitrous Spirit of the Nerve mixed with the Oil of the Blood accended and rarefied; much less the Acid Spirit of the Nerves, with the Alcaline of the Blood, or the Ebullition of the Air and the Arterial Juice; or the attractile Strength increasing amongst the smallest Particles of the Humours: For these Things are repugnant to the *Phænomena* of the Organs of Sense, of Matter, Mixture, Proportion and Duration, nay, there is no necessity for them at all.

But that Influx happening equally into all the Muscles of the Body together; cannot at the same time

The Action of the Muscles.

time flow into the Heart being contracted, but must be thrown into its Nerves; from whence this, completed by the *Auricles*, the *Vena Cava*, and the *Pulmonary* in its Cavities, by the Coronary Arteries in the Substance of the Heart, and by the Nerves in their *Muscular Villa*, in a moment is violently contracted; afterwards relaxing, is fill'd again, and so alternately is always in Action and at Rest.

But how much or great this Muscular Force is, he only understands that knows, 1st, The Place where the contracting Tendon is inserted to the contracting Part, as to distance from the immoveable Centre, about which the Flexure is made. 2ly, the Obliquity of Direction by determinate Angles, which are here frequently very acute. 3ly, The Weight of the very Part moved. 4ly, The Weight of the Body hanging to and raised up, together with the Place in which it is apply'd. 5ly, The Duplication required to the utmost of their Strength, that a drawing might be made towards a fix'd point; which the incomparable *Borellus* hath demonstrated from Mechanicks.

But how such a Spring or Force can be given to the Muscles by the Nerves; *Mariot* hath explain'd to us, in his *Hydraulick* and *Hydrostatick* Engines; and that the Strength of the Muscle is directed with wonderful mechanical Helps, which are: 1st, Membranous Shreads or Bands, largely expanded, surrounding the Muscles and subjected Tendons, and coercing or binding them close, as at the *Carpus* and at the Feet. 2ly, Broad Muscular Bands, such as are in the Arms, Back and Thigh, saith *Vesalius*. 3ly, Or according to *Cowper*, that are in the cartilaginous *Trochlea*, as in that of the Eye, or in the osseous ones, as in the *Pterygostaphilinus*. 4ly, In another transmitting and directing Muscle, as saith *Casseri*, is in the *Styloceratohyoideus*. 5ly, The Tendons of the Muscles, sustaining, elevating and directing

recting or guiding the *Hypomochlea*; as the *Patella*, saith *Vesalius* in the Knee, the *Sesamoide Bones* at the Articulations of the Fingers, with the *Appendixes* annexed to the Bones, as the *Trochanters* are in the *Os Femoris*, according to the same Author, with the Circumduction of the Muscles themselves about the Bones, as the *Marsupialis*, as *Spigelius* calls it, or the internal *Obturator*.

But the contracting Force of the Muscles is increased, much more as the Muscles are compos'd of many smaller Muscles, all which by uniting their Tendons into one, agree to make its Strength much greater; as for Example in the *Deltoides* of *Lower*, the Pectoral Muscle and *Biceps humeri* of *Vesalius*, the *Triceps Femoris* of *Spigelius*; for as there are many Fibres, the Muscle is stronger; as the Fibres are longer, they are so much the fitter for a greater Flexure.

The singular Action of every Muscle is easily known, if the Connexion and Direction thereof be known, and the appointed Motion of the Parts, with which the Tendons are united.

Therefore the voluntary Muscles have Nerves, deriving themselves last of all from the *Cerebrum*.

But those which serve for spontaneous and vital Motions receive their Nerves from the *Cerebellum*.

A Motion remaining in the Fibres after Death, is from a spontaneous Contraction, or drawing together of the Vessels and Fibres.

But a Contraction of a Muscle, does not by any means proceed from a spontaneous Contraction, or a Contraction of a Nerve.

Tho' the Nervous Juice acts strongly on a Muscle, yet it injures not the Nervous Pipe; as from Hydraulicks may be seen.

A Muscle too long and powerfully stretched, grows painful, and is inflamed, the Reason is shown
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in the Example of the *Tetanus*, which is a Rigour or Distention of the Nerves.

The Muscles being alternately moved and relaxed, the Blood is reciprocally express'd and admitted with great violence, by which means it may often and in every Part, be attenuated, dissolved and ground, as in the Lungs, &c.

And this agile Effect is best understood, by comparing the Difference betwixt Exercise and a cheerful Way of living, with that of a melancholy and sedentary Life.

In too much Idleness, the Oil collected in sound healthful Bodies, compresses the Vessels, and closes the Fibres.

An Animal exercising the Motion of the Muscles too much, grows lean, as Horses and other Beasts.

Age and a laborious Life, changes almost all the Muscles into Tendons, and those into Cartilages and Bones.

The Function or Office of the Skin.

THERE is a cellulous Membrane saith *Malpighius*, spread over all the Muscles under the Skin, which is furnish'd with Arteries, Veins, Nerves, Lymphaticks, and oily Cells, very dilatable, and which is able to grow out to any Dimension, encreasing from Fat that stagnates in round Cells, tho' it is fine and oily; this being secreted by a slow Motion into additional Bags, serves for defending, lubricating and unctuating the Muscles; and may be of use to temper the Acrimony, and put a check to the violent Motion of the Blood.

Near to this Bed of Fat lies a thick Congeries or Heap of Nerves under the Skin, wrought into the Form as it were of a Membrane, render'd tough and gross from the hard Integuments of the Nerves,

and every where compos'd of Arteries, Veins, and lymphatick Vessels; from whence several other Things incumbent thereon shew themselves.

But for those Nerves, arising from that Texture, they form *Pyramides*, which depositing an exterior Covering bestowed from the *Dura Mater*, by those *Exuviae* or little Skins, they compose a reticular or net work Body, discover'd first of all by *Malpighius*, in the Feet, Hands and Tongue, but shown more elegantly by the famous *Ruyssch*; which being pierced thro' by as many *Foramina* or Holes, as there are *Papillae* or Nipples arise, it transmits those soft nervous Pipes or Conduits throughout the whole.

From those nervous interwoven *Stamina*, at certain Places there spring up fine acute or sharp Bodies, call'd Hairs saith *Malpighius*; of which others from the very Glands of Fat seated betwixt, rise deeper, and being propuls'd from beneath, dry in the Air serving for a Defence to the Skin, and to close the Pores.

But there are innumerable Branches from the *Arteries* under the Skin, that being dispers'd and interwoven, send forth subtil, fine Vessels, which opening outwardly, emit in Health, a thin, volatile, odorous, salt, invisible Vapour, perspiring under the *Epidermis*; but these Pipes being more relaxed, or the Humours more agitated, it issues in form of Sweat.

But the subcutaneous Veins made by the like *Apparatus*, opening their small Vessels outwardly, ending in them, exhaling nothing, receive extrinsically the Liquors insinuated into them, and first mix *Lympha*, and then Blood, as many and certain Experiments teach us

But there are in the external Skin *Meatus's* or Passages that are large, perpendicular, deep and cylindrical, in which internally on all sides, the exhaling Mouths protrude their Fluids, which being there collected,

The Excretion of Sweat.

collected, stagnating and drying, they pass into a vermicular Paste, that growing black in the Air, is oftentimes the Cause of many cutaneous Diseases.

Upon this saith *Ruyfch*, lies the *Epidermis*, or Scarf Skin, entirely separable from that underneath; divisible into many *Lamellæ* or Scales, consisting of no Vessels, that can be made visible by any Art; endowed with no Sense, being wholly squamous or rough, so that it is incredible, saith *Leewenboeck*, to see the small Scales, cut into various Figures, the Furrows, Holes, &c. that are in it agreeable to *Malpighi*, and which are chiefly to be seen at the spiral Tops of the Fingers: In the middle of these Furrows the sudoriferous Vessels lie securely, but on each Parallel side of the Furrow, a Series of nervous *Papillæ*, from whence it is manifest, the sweating Vessels and those of Perspiration, the *Papillæ* of feeling, &c. are defended by this slender Covering.

The Excretion of Sweat.

UNder the Skin it self upon the Fat, throughout the whole Circumference of the Body, are seated the milliary Glands, closely united and compos'd, or made up of an Artery Vein and Nerve, forming an emunctory Vessel, that arises by a *Foramen* in a reticular Body, that spues out Sweat by an open Orifice under the *Epidermis*; and is cover'd with a hollow Valve, rais'd up and round, that is, posited under the *Cuticula*, powerfully to transmit and coerce the Humour; this is the Principle Organ of Sweat, to which from thence, other Vessels of *Ruyfch's* Discovery are added.

The *Sweat* thus secreted, is different according to the Difference of Air, Climate, Sex, Age, Diet, &c. as hath been said of *Urine*.

In a healthful State there is scarce any, except from an Error of the *Six Non Naturals*: In its first Effect, it is always noxious or hurtful; by Accident sometimes it is profitable.

The Perspiration of Sanctorius.

There are besides, exhaling or perspiring Vessels, under the *Squamula* or Scales of the *Epidermis*, that lie obliquely open, but are of that subtil Smallness, that there are computed 125,000 Apertures in the Compass of one common Grain of Sand, according to *Leeuwenhoeck*: From these a subtil Humour perpetually perspires from every single Point of the Body, call'd after the first Inventors Name *Sanctorius's Perspiration*, to which Invention and the Perfection thereof, the Glory of this Opinion is owing.

This Exhalation is made throughout all the external *Epidermis*, as also in the *Cuticula* of the Mouth, Nose, Jaws, *Larynx*, Lungs, Gullet, Stomach, Intestines, Bladder and Womb; from whence the Quantity thereof exceeds the aggregate or collected *Fæces* of all the other Excretions; for in the Air of *Italy*, in a vigorous State of Life, and moderate Diet, it equals five eights, of whatsoever is eat or drank.

The utmost Fineness, a regular Equality, great Plenty, together with the Lightness to the Sense, and adding Weight or Encrease to the Stature; Augmentation after Sleep, demonstrates the Body to be perfectly in Health; and is a special Help to the preserving it so.

But a Recess of Perspiration from these, is almost a certain, and the first Messenger of an approaching Disease, nay, perhaps the Cause of it.

The *Viscera*, Vessels and Fibres being strong, effect, preserve, augment and restore this Retreat of Perspiration: Exercise of the Body at the very
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Beginning of a light Sweat, a moderate Use of Venery from the Strength of Constitution: Seven or Eight Hours Sleep with the Body well cover'd, but not with too great a Weight of Cloaths, Cheerfulness, Youth, solid, light fermenting Food, not too fat, but a little season'd, a pure serene, dry, heavy, cold Air.

But all things that are contrary to these, as well as all the other Secretions, being more increased, lessen, impede and deprave this.

Hence it is plain to us, what this perspirable Matter is, its Cause, Effect, Necessity and Use, that is past repairing in the first place, by reason of the Flexibility and Softness of its Vessels; especially as the nervous humid *Papilla* are apt to be affected from the Objects, and by transmitting the impress'd Effects of those, they are ready for such Actions and so continue.

And so it is understood from the Encrease of Sweat, and the Enlarging of its Vessels, that Perspiration must necessarily be diminish'd, and the Vessels thereof compress'd.

In like manner, by violent Motion and too much Heat, this perspirable Matter is converted into Sweat.

But it is greatly assisted from moderate Motion, and Warmth.

But nothing hastens it, or conduces more towards it, than gentle Frictions or Rubbing, and that continued for some time together; but constant Sweats and such as are great, relaxe, debilitate or weaken extremely, and that always and necessarily will happen to such as labour under, and often die of Weakness, *Atrophies*, *Phtisicks* and *Syncopes*.

But why presently, and for some time after eating, is the Perspiration smallest in a healthful Man? and why the largest Perspiration betwixt the Fifth and the Twelfth Hour from Meals? for which

which reason, Riding on Horse-back, Coach, &c. especially a brisk Motion on the Ice, or in Snow, chiefly promote that.

Of Nutrition, Encrease and Decrease of Substance.

THat a human Body may exercise all those Motions of the Humours, Vessels and Muscles, and that none of them may in the interim be destroy'd, there is required a ready Flexibility in the Vessels, Muscles and Fibres; to the obtaining of which, the Parts cohering or sticking together ought to be chang'd, partly from Contact, and partly to continue therein: Which cannot be done, except the great Parts be made up of the slenderest, thinnest and shortest; neither can this happen again, unless amongst these there constantly run a renovating Fluid or Humour that hinders concretion; therefore the whole Body, as it is flexible, ought necessarily to be made up of these small Vessels.

Yet in that very Motion, in the Vessels that are of a fine Structure, assiduously and violently exercised, as well by a perpetual Circumduction of the Humours as the muscular Actions, the smaller Parts are necessarily grounded or broken in Pieces from the Solids: The Parts thus exercised by grinding, are mix'd with the Fluids, are agitated and exhaled; in the mean time, the Fluids made less by continual Attrition, proceed to the perspiring Vessels, and vanish out of the Body, hence from that Condition, a Live Body is soon destroy'd.

Therefore for Continuation or a Constancy of Life, there is need that there be so much, and of such a nature, perpetually restored to the Fluids and Solids, as was lost by those Motions: This
is

is said to nourish or sustain, and this Action to be Nutrition.

But the Humours being wasted, as to Matter, from Meat, Drink and Air, as to the requisite Functions thus far expended, on the concurring Strength of the Body, they are repair'd or recruited, and apply'd to their proper Vessels.

The Nutrition of the solid Parts being something obscurer, is understood from the Knowledge of the following things. Every solid part of our Body, is form'd or made up of others much less Parts, how like soever to the greater: Vessels from Vessels, Bones from lesser Bones, and this Fabrick proceeds on, beyond all the Limits of Sense, by what Art soever assisted, as *Malpighius*, *Ruyseb*, *Leeuwenhoek* and *Hook*, have prov'd by accurate Experiments. Yet this Division seems almost to proceed to Infinity, as the Nature of the Aliment and Humours teach us.

Besides, the Microscope, Injections, small Wounds, blistering Medicines, Wasting, Dryness inform us, that our Solids compar'd with the Fluids, are but very few: But it is plainly demonstrable, from the Consideration of the Rise and Generation of the Vessels, and from the Resolution of the largest Vessels form'd into smaller, that the whole solid Mass of our intire Bodies absolutely consists, or is made up of nothing else but mere Nerves or Filaments, as their Elements or Principles.

And indeed all that Mass, being taken from an incredible small Particle, grows from those things, which before were so subtil, that they were but just a dissolving or fluxing Liquid, like to that of the nervous Juice; as we have taken notice already in that of the incubated Egg, observed by the curious *Malpighius*.

For neither does the White of the Egg nourish at first, till being incubated, it hath passed by that Energy,
from

from the Thickness of its Humour, innumerable Degrees of Fluidity, thro' diverse Waters, at last terminating in that Subtily; but then that Liquor, as yet bestowed on the *Embryo*, is thick, and is transmitted much finer in its Vessels and *Viscera*.

But from this subtil Humour, the first tender Solids arising, almost like Liquids, they pass again thro' infinite intermediate Degrees, till at last it is brought to the solid Parts, as *Malpighius* hath taught in Eggs, and the incomparable *Ruyfch* hath discover'd and shewn in *Embryo's* and *Fœtus's*; nay, he hath given us an accurate Enumeration of their various Parts. Wherefore it is hence evident, that the Solids in their first Rise from the Liquids whence they are derived, only differ in Rest, Cohesion and Figure.

Therefore such a Particle now fluid, will make the Part of a Solid, from thence formed, and Strength being added to it, effecting the Cohesion thereof with the other solid Parts, howsoever that is performed.

Which Cohesion produced after the best manner in a Fibre already made, if the Place be large enough in the Solid that remains from the Particle of the Solid that is destroyed, and likewise in the Fluid, the Particle answering in Substance or Size, in Figure and Nature; and also the Strength or *Impetus* that intrudes that Particle into that place, or accommodates it there.

Therefore the Nutrition of the Solids is made in the smallest or minutest Vessels, from the greatest Conjunction of which they are made, that is, in the Nerves or Vessels most like to them; but since that cannot be done, except some Liquid be carried into these Vessels: Is it not plainer to you therefore, that the matter nearest or most agreeable for Nutrition, should be a subtil nervous Humour, most likely or probable for that Use?

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Don't you from hence believe, that Nutrition is perform'd from the last and most perfect Actions of Nature? and that it may be done well, it is likewise necessary, that the former Actions be so too. Therefore the *Chyle* may fill the Vessels; but it cannot recruit or supply the Solids; also in the Lungs, by the Strength of Respiration, the *Chyle* being attenuated, chang'd, subdued, mixed, and render'd fit to pass thro' the Vessels, is indeed a properer matter than before, but not yet aptly prepared for this Work of Nutrition.

From hence repeating the Operation or Effect of the Lungs, *Viscera* and Vessels, there is made a soft, tenacious, plastick *Serum* that is almost tasteless and without Smell, growing thick before the Fire, and also doing the same in Spirit of Wine, likest to the White of an Egg; and therefore such a Fluid, in which are all the Conditions, that are in that Humour, from whence we certainly are assured, from that single Experiment of an incubated Egg, how all the solid Parts of an Animal Body are daily made: Therefore, tho' happening again in a more proper degree, it is not yet made ready for Nutrition, much less red Blood; entring into the smaller Vessels, neither one nor the other.

But as the Heat of Incubation, so the Action of the *Viscera* and the Vessels, on the *Serum* thus agitated or moved about, introduces various Changes, till part of it goes into so subtil an Humour, as is here required, fit to repair the consumed Parts; and this is the true immediate nutritive matter.

Which how simple it is, tasteless, and without Smell, the Fire, Putrefaction and the Chymical Art teach; for they leave behind a mere light insipid Earth: Yet the last matter is not found to be fitly elaborated, unless with these degrees; but the very same Humour often more acrid from the too often repeated

and Circulations, and being destitute of the more liquid Part; render'd sharp from its Oils and Salts, by that means it is return'd improper and unfit for Secretion. Hence there is a necessity of new *Chyle*, and consequently of Aliment and Drink, as requisite to this Nutrition.

The manner how, and the Cause from whence this is done, are understood from what follows. An Humour puls'd directly thro' a full Canal, conick or cylindrick, elastick or rigid; if it flows from a broad one into a narrower, or with some Resistance made against its Motion; it endeavors to make the Sides of its Canal, near the Axis of its Longitude: Which is done every where in the Body, except perhaps in the hollows of the Veins and their Receptacles.

But by this Labour, either constantly by Repetition in a less degree, or by little and little insensibly, these Vessels are length'ned, and by their Elongation, more and more attenuated or spun out finer, and that in a short time. Hence the last Extremities of the Vessels, tho' very fine in us, cohering less together, that is, being next to a State of Dissolution, are perpetually affected: Therefore the extreme Ends of the Vessels are render'd so fine and ductile or yielding, that they scarce differ from Fluids.

Therefore while that Motion goes perpetually forward in a continued Propulsion, these Two are necessarily made, first of all, to wit, the last Particles of these fine Pipes being worn away, are carried again, as it were, into a kind of Humour or Fluid, lastly, in whatsoever Part of the Body they stick: From thence the smallest Particles, which compose the finest Fibrils by their Union, are so separated from each other mutually, that they leave empty Interstices in those Places, where they adhered before. But this is done every where, and both

both these things happen constantly, and that in every Part, as long as it lives, especially where Life is vigorous, and the Actions of the Body violent.

But the same Humour, from whence these are made, contains abundance such like Particles as they were, which are thus separated or destroy'd; it conveys, mixes and applies them to those very Interstices, but with that *Impetus*, whereby it endeavours to ruin the Canals; from whence it forms, coagulates and binds in intermediate Bodies in this Passage. So that they adhere and stick just like the former: Notwithstanding the Matter, Preparation, Application, Strength and Motion, continue always the same; therefore what is lost, is nicely restored. So that the Solids remain as they were, that is, they are perpetually nourish'd and preserv'd.

But that shews the ineffable Wisdom of our Creator in this thing; that the same Cause which inevitably destroys, in like manner, can repair or make again the thing destroy'd by the same Work or manner of Operation; from whence also 'tis taken for granted, by how much greater the Consumption is, the larger is the Supply: Lastly, That those Parts, which are first of all wasted in the Action of the Body, are precisely, and that before the rest, always the best recruited.

It is evident, those Vessels, which are most tender and delicate, and best adapted or nearest to the moving Cause, are for that reason most easy to be elongated, distended, wasted or repaired: Therefore our Bodies, by how much the nearer they approach to their first Original, from thence they increase and grow out the more.

In the mean time, while that Action goes forward, the larger Vessels become more extended by their Liquor, but the small ones at the same time, whose Contexture make the Membranes of the greater,

ter, are render'd juiceless, being compress'd and growing together, from whence comes the Firmness of the Fibres, but the Loss or Destruction of its Vessel.

Likewise such as have been Vessels some time in the Body, are from hence observ'd to become mere hard Ligaments; that at length we may be perswaded, that the Vessels form a Co-alition, or Union from the concreted Humours by the same Necessity.

Last of all, from the Concourse of these Causes, the Strength, Hardness, Rigidity and Thickness of the Solids proceed; therefore the Number of the Vessels is greatest in the *Embryo*, but as Age increases, they gradually decrease; contrariwise, from the same reason Weakness wears off, Strength grows up: Consequently, in Youth, the quantity and force of the Fluids exceed the Solids; in Age, the Solids in strength and number exceed the Fluids. From whence is understood the State of Increase and Decrease, the Manner, Cause, and different Appearance of Death in pure Old Age.

But he that considers all this History, from hence those things which happen to the Body, and compares them together with that, will see indeed that all these are perform'd thus; for the whole Cuticle in every Part is constantly scaled, perisheth, and is renewed again: The Hair, Nails, Teeth, being daily pared, cut, fil'd or the like, grow again: Those Parts that are carry'd away of the Vessels or Bones, by little and little are increased from every Part: The *Sordes* collected from the Extremities of the Vessels throughout the Body, by wasting or exhaling, beheld with Microscopes in perspiring or dissolving, and examin'd in Water, teach us these things are made from the Solids and Fluids, being prepared by washing, grinding, &c. and are like the former.

From

From hence also is understood, that the growing Size of the Body, as to the Habit thereof, in brawny, fleshy, fat Persons, is not from the Increase of the Solids, but from those collected, stagnating, extensive Humours, that fill the larger Cavities; Hence to be fat, is to be subject to Weakness and Suffocation; and therefore how greatly ought a Physician to distinguish betwixt Repletion and Nutrition, since this last strengthens and confirms the Vessels, but the other weakens, relaxes and extends them.

But Reason, from these things shews, or makes it appear, why the Structure of our Solids is not dissolv'd by the Liquors contain'd in them? Also from whence it happens, that this Machine can so long subsist an active Body? What is the Cause, that in corrupted Nerves, the Nutrition of the Part perisheth that is endowed with that Nerve? and likewise why the same obtains in the Artery? why there is no Solids in the *Embryo*, few in the *Fetus*, and very many in such as arrive to Age, nay in these, Nerves, Tendons, Arteries and Receptacles are made into Cartilages, and afterwards into Bones.

At length we may know how many sorts there are, and also how often the Circulation of the Humours of our Body are perform'd? likewise of what kind and how various are the Effects of it? And again, how those Problems are to be solv'd, whereby the accurate time is sought, in which all the Humours together pass thro' the Heart? And also others of the like nature, which may seem easy to the hasty and unthinking, but are most difficult to such as examine with Deliberation, and appear almost impossible to be resolved.

Order requires next that we treat of Sleep and Waking; but since in them, there is always something to be said of Rest or Exercise, and of those things which relate to the internal or external Sen-

ses; the Order of things now leads me to an Enquiry into the external Senses, and first of common, universal simple Feeling.

Of Feeling.

THE soft, pulpy, medullary, nervous, pyramidal *Papillæ*, arising from under the hard, subcutaneous Nerves, from the naked exterior Membrane, hence are made truly sensible, being moisten'd continually by a subtil Liquor flowing thither, and defended by the thin *Epidermis*, from its pure Sensibility; they lie inclosed betwixt the *Sinus's*, and the little Holes or Cavities under the *Cuticula*, in Places most proper for exercising the Act of Touching, to wit, in the Tongue, at the very Ends of the Fingers in the Hands, and in the Feet; and this is the corporeal Organ, whereby these Bodies are said to touch or feel.

In which this is wonderful, that they are perpendicular in the remaining Superficies of the Body, but lie extended about the tops of the Fingers and Toes, according to the Length of the Fingers; hence, saith *Malpighius*, joining with the *Epidermis*, as in a Sheath or *Vagina*, being complicated and dry, they are harden'd in the Nails, rendring them fit for defending the *Papillæ*, and hindring them from becoming callous.

The Touch then is made, when the Tip or Extremity of the Finger is apply'd to the Subject, and the *Papillæ* are emitted from the Attention of the Mind, by gently rubbing upon the *Superficies*, so that some Motion is impress'd upon these *Papillæ*, the Effect of which spreading to the common Sensory, excites an Idea to the Mind, of Heat, Cold, Moisture, Dryness, Softness, Hardness, Roughness, Motion, Rest, Distance, Tirillation, Itching, Pain.

Why

Of Tasting.

Why else is there such Pain from the Sense of Feeling in the *Epidermis*, from bruising, scalding, burning, &c? Why the feeling lost from a thick, hard, callous Cicatrice in the *Epidermis*? What is the Cause of that wonderful Motion of trembling, and the Hands of such growing numb by degrees that touch the Cramp-fish? From such cruel Pain at the internal Superficies of the Nails, affixed to the *Cutis*, and at the Roots thereof? Why is the Sense of Feeling so acute there, where the cuticular Furrows are spiral?

Of Tasting.

IN the back part of the Tongue, especially at the tip and sides thereof under the Skin, say *Malpighius* and *Ruyfch*, lie hid obtuse *Papillæ*, which in Tasting emerge from the live, warm, moist Tongue, but is gone in Death; but first of all distinguishable in Hunger: These Spring from a nervous Body, incumbent on the muscular Flesh of the Tongue, from whence they arise thro' the reticular permeable Body, as hath been already mention'd in the *Cutis*; then being set with erect, little Sheaths of the exterior Membrane of the Tongue, they defend them against the Sharpness, Acrimony and Heat of the things taken into the Mouth; but these *Vaginae* are porous, and so eminent or discoverable, that the squeez'd Aliment how great soever, runs into them as they receive it.

And it will appear probable, that the *Papillæ* are very numerous, which arise, saith *Willis*, from the ninth Pair of Nerves, giving one to the Tongue, and which is distributed thro' it; but the Branch of the fifth Pair serves it for its muscular Motion, as is made evident in another Place.

Bellina proves from Experiments accurately made, that these *Papillæ* make that Organ, in which the apply'd savoury Objects raise a Taste, but act nothing upon any other Parts of the Mouth, Tongue, Jaws and Palate.

That Matter in Vegetables and Animals, from which Art draws Salt and Oil, either Mix'd, or separate, is the true Object of Taste, and therefore Salt, Soap, Oil and Spirit, is the same as that in Fossils.

Taste then is excited, if the matter to be tasted, is attenuated, often dissolv'd in the *Saliva*, heated in the Mouth, apply'd by the Motion of the Mouth and Tongue, insinuated amongst the Pores of the membranous *Vagina*, penetrating to the Surfaces of the *Papillæ* lurking there, it affects and moves those, and so bringing the impress'd Motion to the common Sensory, it excites or raises in the Mind an Idea of Salt, acid, alkaline, sweet, vinous, spirituous, bitter, aromack, hot, acrid, austere, or something else compounded from these.

Furthermore, the Cause readily shews it self, from which such a different Taste is rais'd from the same Subject, according to the difference of Age, Temperament, Disease, Sex or Custom of other things first apply'd to the Palate.

But why should the most savory things be next to the most painful, as saline, aromack and spirituous Bodies are, if apply'd to the naked Nerves or the Tongue, when excoriated?

Why do savory things soon restore or make new again? Why are Water, Oil and Earth so insipid.

Of Smelling.

THE open Nostrils proceed from a wide Passage tending upwards into a narrower, and being double,

double, are best fitted to attract and draw in the Air, applying the more volatile and odorous Parts to its Superficies; especially while they are closed together, being united by the Action of the Constringers of the Wings, or Risings on either side of the Nostrils; which, according to *Cowper*, being carneous, are inserted from the foremost lower part of the four Bones of the upper *Maxilla* to the Wings of the Nostrils.

But the Capacity or Largeness of both the Nostrils, takes in that space into which the frontal *Sinus* opens agreeable to the Descriptions of *Palsin* and *Higmore*; which are chiefly form'd betwixt the remote *Lamina* of the *Os frontis*, under the Eminence subject to the Eyebrow, and opening from thence a *Foramen*, that on the upper part communicates to the Cavities of the Nostrils, next the upper Bone of the Nose, they receive amongst them the mucous Membrane of the Nostrils, with which the whole interior *Superficies* of the Cavity of them, is encompass'd and cover'd; and in which the generated *Mucus* distills into the hollows of the Nostrils.

The great Caves of *Higmore* form'd in the upper *Maxilla*, opening themselves by a gaping *Foramen* into the Cavities of the Nostrils, also receive the same Membrane, saith *Palsin*, elaborating, collecting and excerning the *Mucus* therein. The little Cells, *Cowper* mentions, of the *Os Cuneiforme* under the upper spongy Bone of the Nose, that frequently by distinct *Foramina*, lying open to the Cavities of the Nostrils, receive the mucous Membrane of them, are cloath'd therewith, secern a *Mucus*, and emit or send it forth, by this very Passage.

There are besides that, that lie covered in this hollow of the Nose, being artificially dispos'd, four little Bones, call'd the spongy Bones of the Nose, there being two in each Nostril; the upper one, saith *Palsin*, is united forward to the upper Part of the

maxillary Bone, where it is united to the *Apopbysis* of the *Os frontis*, at the internal Angle of the Eye; the other, saith *Cowper*, being the lower, is joyn'd in the lower Part of the Cavity of the Nose, to the maxillary Bone. These four little Bones are so wonderfully fabricated or wrought, from the fine *osseous Lamellæ*, being thinner than Paper, and so situated, that they have several little cavernous hollows, amongst which the mucous Membrane so insinuates it self, that it goes in and out, nicely investing the Superficies amongst the *Lamellæ* and leaves the hollow free: These Cavities of the small Bones and all the Cells, opening without any Restraint into the Cavities of the Nostrils.

The Nostrils are cloath'd with a thick soft Membrane, furnish'd with vast Numbers of little Arterial Vessels, as well as it is provided with round glandulous Bodies, and also fine small Vessels pouring out, or distilling a subtil *Lympha*. This Membrane insinuates it self into the Cavities of the six *Sinus's*, and the Cells of the four spongy Bones, from whence by an admirable Institution, in that strait Cavity of the Nostrils, the Superficies of this expanded Membrane is much increas'd; so that one Part scarce gives way to the other.

The olfactory Nerves, according to *Ruyfch*, *Vesalius* and *du Verney*, proceeding without the *Dura Mater*, to the *Os Ethmoides*, apply their tender Fibrils to the little *Foramina*, that are found, says *Palsin*, in that Bone, which is penetrated with small *Vaginulæ* or Sheaths from the *Dura Mater*, by these the Fibres going out of the *Os Cribriforme*, are presently distributed throughout that whole large Superficies, and that very curiously into every *Sinus* and *Cell*.

From whence it is certain, that the Expansion of those Nerves is very broad, neither are there in any other Part of the Body Nerves so soft, and therefore

fore uncover'd, and consequently that can be so easily affected or hurt as in this Place.

Hence from all that vast quantity of Glands in the same Membrane, and also of Arterial Vessels so plentifully distributed here in form of a Knot or Bundle, here is constantly prepared and excern'd a soft, fluid, inodorous Humour, that is almost tasteless and without Colour, which moistens, lubricates and defends the Nerves on all sides, and in every describ'd little Cell or Cavern; being always made quiescent, stagnate and inspissate; lastly, in whatever Part of the Body it is found flowing, it is call'd the *Mucus*: From the Effect of which that is perform'd, which would scarce otherwise happen; for those tender naked Nerves remain or continue good for a great Number of Years. Yet that this Liquor might not easily be chang'd into a crust or sandy Substance, by long stagnating and thickening too much amongst the Cavities, and so be render'd unfit to pass out thro' the narrow Ports of those Receptacles; there is a Branch of *Willis's* fifth Pair of Nerves distributed hither, that is, brought from its Union with a Nerve of the sixth Pair; irritated with which, the *Intercostal* and *Vagus* of *Lower*, and consequently the Nerves of the Muscles serving for Respiration are moved, from whence Sneezing being made from the Force of the Air, puls'd or driven by a violent *Impetus*, and rushing into these Caverns, the *Mucus* is absterged or cast off.

But that Part is the Object of Smelling in Animals, Vegetables and Fossils, which adheres in the Spirit, Oil, Salt and Savour thereof, if it can be so divided, as that it be able to fly and be spread abroad in the Air: But it is plain from the Number of Experiments, that that subtil Body which is call'd Spirit inherent in Oil, is that first Mover which excites the Smell; for this being separated from the odorous Bodies, the Residue is scarcely

fragrant, but that being pour'd upon the rest recovers the Smell.

The Animal breathing thro' the *Aspera Arteria* or Windpipe, when it is cut in the Neck, and the Air passing thro' the Wound, perceiveth no Smell at all, tho' from the strongest Scents.

When the Air is expell'd from the Lungs thro' the Nostrils in Expiration, there is Smelling, the odorous Subject placed without ; likewise there is scarce any in holding the Breath ; but the Smell is perform'd by drawing the Air thro' the Nose.

But the stronger any one draws, and the quicker he expells it reciprocally by turns, the better the Action of Smelling is perform'd.

By Motion, Heat, Grinding, and the Mixture of different things, by a cautious Mixture of Salts to the oleous odorous Subjects, the Odour of the things to be smell'd is increas'd.

Therefore the Sense of Smelling is perform'd, while the odorous *Effluvia* contain'd in the Air, are strongly enough attracted or drawn thro' the Nostrils by the Motion of Respiration, and in that Figure are apply'd with Force to the olfactory Fibrils, from the Position of the little Bones united thereto, they act thus upon them, and communicating this Action to the common *Sensory* they excite the Smell of Acid, Alkali, Aromatick, Putrefaction, Wine, sweet or sour, and so on.

Hence we may readily understand, how great an Affinity there is betwixt odorous and savory Things, or betwixt the Objects of tasting and smelling.

Why do Odours oftentimes restore Life in a moment ?

From what Cause do they sometimes occasion Diseases, and Death it self ; nay, almost all kind of Operations medicinal and poisonous ?

Where?

Wherefore in different Men does the same Smell produce such different and opposite Effects, from the same thing smell'd to ?

How comes it to pass, that Animals who have the longest Beaks, or Bills, the largest spongy Bones, shou'd yet enjoy the quickest Smell ?

What is the Reason, why a fetid Exhalation from the putrefied Parts of Animals, or Vegetables, once impress'd on the Nostrils, shou'd stick or remain there so obstinately, and with such Trouble for so long a time ?

The strongest Odours are they not apt to sneeze ?

What Use is there of the Humour and *Mucus*, daily generated and distributed thro' the Nostrils ?

Why is a dull Smell quicken'd after sneezing ?

Is that Humour serviceable for purging the Brain ? And how far ?

Whether is the *Mucus* when generated at first thick ? Or is it made so afterwards ?

From whence comes such a great Communication of the interior Nose with the Muscles serving for Respiration, and the *Abdominal Viscera* ?

Is not sneezing a Convulsion thence therefore, it wearies so, often creating Pain, and sometimes Death ?

Of Seeing.

THE Ridge of Hair that is placed Arch-wise, on the rising Part of the *Os Frontis*, is call'd the *Eye-brow* ; the erect, stiff Hairs that are born on the external Edge of the Eye-lids ; springing from their little Bulbs, are call'd the *Eye-lashes*, which hinder small light floating Bodies from falling into the Eye, either from above, beneath, or sideways.

The Muscle call'd the Depressor of the Eye-brows, arises on either side, from the Bone of the Nose,
where

where it is joyn'd to the anterior *Apophyſis* of the *Os frontis*, and inserted in the finer Tendons under the elevated Part of the Eye-brow; making it a better Defence for the Eye to preserve it from Filth and Dust; and also a Shade to the Eye, being placed into bright a Light; whilst contracting the *Supercilia*, it draws it to the upper Eye-lid, and compels them mutually to come near or joyn each other; but the frontal Muscle saith *Vesalius*, elevates again the *Supercilia* where there is occasion.

Both the *Eye-lids* being membranous, thin, plyable and vasculous, are always moist in the internal *Superficies*, being furnish'd with a broad cartilaginous Arch, where they happen to be open or shut by turns, or removed by repeated Endeavours, they likewise defend and clear or purge the Eye: For the *Elevator* of the upper Eye-lid saith *Fallopins*, arising from a narrow carneous Beginning, out of the very bottom of the osseous Orbit, going upon the ascending Muscle of the Eye, being dispers'd into the fine tendinous Fibrils, is inserted to the upper Part of the whole *Tarsus* of the Eye-lid; which moving elevates the upper Eye-lid without wrinkles, but the orbicular Muscle of *Cowper* and *Bidloo*, arising from the larger Bone of the Nose, interspers'd with orbicular Fibres thro' each Eye-lid, by contracting it self like a *Sphincter*, and joyning by a moderate Motion to another, it presses the Bulb of the Eye with a stronger Contraction. But the lower *Eye-lid* is open'd by a spontaneous Contraction of Muscular Fibres, distributed in the *Eye-lid*, according to *Bidloo*.

But lest the Eyelids continually winking, shou'd be excoriated by squeezing together, there are in the side or border of each of them, saith *Valsalva*, little granulated yellow Glands, that separate an Humour as it were from Fat and Wax mix'd together,

ther, which serves to anoint and lubricate the Edges of the same.

The innominate Gland, as *Bidloo* describes it, being large, broad, compress'd, rough and conglomerate, is seated betwixt the Orbit, towards the external Angle of the Eye near the rough Chink, wraps up in Fat, supply'd with Arteries, Veins, Nerves, Lymphaticks, and *Hydro-opthalmick* Ducts; making from the Arterial Blood a salt, watry, pellucid, soft Humour, always in some small Quantity, but in much greater upon rubbing the Eye, or from the Action of compressing the *Orbicular*; the Tears fall down betwixt the Bulb of the Eye, and the internal Superficies of the upper Eye-lid, moistening, lubricating and washing the Eye; being of use to hinder it from Concretion or sticking to the Eye-lids; and this abounding Humour is call'd *Tears*.

Certainly, each of these Humours being of one Figure, with absters'd *Sordes* and the determinate Concourse or Meeting together of the Edges of the Eye-lids; which being shut, leave a space, in the great Corner of the Eye for receiving these; which being form'd from a spongy Caruncle posited there, is determined into that space; there the grosser Part being fixed and gather'd into the Roughness of the said Caruncle, it turns being dry'd into a gummy Substance, but the liquider Part, wonderfully press'd by a determinate Motion into the dilated *Foramina*, seated in the extream Angle or Corner of each Eye-lid, which are call'd the lachrymal Point; brought out from which, the lachrymal Canals run together along that Caruncle, into a lachrymal Bag placed in the Canal of the Nose saith *Vesalius*, which is made from the meeting together of the *Os Unguis*, and the Fore Bone of the upper *Maxilla*; from which by a Pipe that is always open, it is carryed into the Cavity of the Nose, immediately under the inferior spongy Bone; from whence the Cause is known why from Persons crying,

crying, there is a *Stillicidium* thro' the Nose; and why in a healthful Constitution, all that Humour vanisheth.

So Eyes that are expos'd to the Air, are preserv'd, moist, clean, pellucid, slippery, moveable, warm, being quickly freed from all sharp or acrid Things, as equally expanded from the distending Cause within.

The Structure of the Eye and the Action thereof, which depends on it, is best understood, if beginning from the optick Nerve, we contemplate it thence in that Order, to which all its other Parts and Functions relate.

From the utmost Region of the medullary Substance, saith *Vieussens*, which produce the optick Nerves under the *Corpora Striata* of the *Cerebrum*, according to *Willis* tending forward, they are accurately united under the *Infundibulum*; afterwards going back again, they come to the round *Foramina* of the bony Orbits, impress'd on the bottom of the Eye, in all this Course being soft and porous, according to *Ruyseb*, they are cloath'd with a single thin Membrane of the *Cerebrum*, made up of many Arterial Vessels, they run securely under the suspended Brain, in their Passage thro' these *Foramina*, being cover'd with the hard *Meminges*, they receive that as a Sheath strongly joyn'd to the former Tunicle, so penetrate themselves amongst the Cavities of the bony Orbits, and there the *Dura Mater* it self is seen water'd with many little *Arteries*.

These internal long Orbits, surrounded by the *Periosteum*, and fill'd with much Fat, receive the *Bulb* of the Eye, as it were like a Bolster, strengthening, defending, lubricating and assisting its Motion.

From thence that *Vagina*, or Sheath given from the *Dura Mater*, entring by the optick Nerve the Orbit upon the said Fat, by and by spreads it self almost into a perfect Globe, membranous and hard as it were like Leather,

Leather covering the whole Eye, growing by degrees leaner, thinner on the Fore Part, pellucid and more prominent; it is call'd the *hard* or *scelerotick* where *opaque*; but the *Cornea*, where thinner and pellucid, first of all serving to strengthen its Figure by its Supply of Vessels, and the sustaining Muscles and Tendons. For by this saith *Ruyfch*, the Arteries and Nerves enter in.

But that Membrane which incloses the Optick, was from the *Pia Mater* entring into the *Orbit*, and encompassing the hollow Superficies of the *Scelerotick*, divisible into Two *Lamella*, endued with infinite distinct *Arteries*, from a different going according to *Ruyfch*, it proceeds forward to the Place, where the *Scelerotick* makes the *Cornea*, where receding first of all inwardly from the *Scelerotick*, it gives a fine subtil membrane, Covering the vitreous or glassy Humour, in the next Place, the *Tunicle* or Coat call'd the *Uvea*, in the middle of which is the *Pupilla*, the contiguous *Lamella* and incumbent on the hard one is call'd the *Chorooides*, that which falls into this the *Lamella Ruyfchiana*.

But while the Edge or Brim of the *Choroide* running out, forms the *Uvea*, it also receives Nerves from those which are call'd to the *Scelerotick*, and perforating this and the *Choroide*, communicated here to that, they are divided into many: From these and the Membrane, the exterior muscular Fibres of the *Uvea* are made tending from their rise towards the Centre, they end in an orbicular Rim or Border, consisting of muscular orbicular Fibres, which bound the Space and Figure of the *Pupilla*: This Rim being reflected backwards towards the interior Parts, binds the internal right Fibres of the *Uvea* in like manner, receiving it larger from the triple exterior one: From whence it appears the orbicular Constringe the Longitudinal, to dilate the *Foramen* of the *Pupilla*. But the little slender Membranes,

branes that are pellucid connecting the Fibres, are cover'd with the darkest Colour, where they regard the back Part of the Eye.

Also in the same Place in the *Uvea*, is a wonderful Arterial Structure form'd into little Rings, and from thence sent into many spreading Branches: But before those Arteries from whence these are risen, in the *Choroide Tunicle*, such like admirable Fabricks are opened: But the Contemplation of this eminent *Apparatus* teaches us, that there is made in the same Place the highest Attenuation of the most subtil Humour, and an easie Reduction of the grosser Portion.

In the mean while, from the same Place, the Circumference of the *Choroide* rising out of that fine little Membrane, is also formed from the arched muscular Fibrils embracing the Gibbous, swelling the annular Superficies of the vitreous Humour, where it shews it self out of the tender Chrystalline; but the fix'd Beginning of these is in that Orb of its own rising, the moveable End in that Orb of the vitreous Humour, where it leaves the tender Chrystalline; the Distance of these is greater than that of those which is in the *Uvea*, which distance the black Colour fills; and also the Blood Vessels are found there after the same manner, as in the *Uvea*.

But the yielding vitreous Body is bound in with the rest, by the proper subtil little Membrane, joyn'd on every side with the thin slender Bands in the Cavity of the *Choroide*, which is so fine that it scarce appears, especially by reason of its pellucid Nature; but by the Distillation of the Water falling from the vitreous Humour, it is found in this small Membrane.

In the exterior Cavity of the middle Superficies of the vitreous Humour, the Chrystalline *Lens* resides unconstrain'd in its lower Superficies, being fastned thereto by the Assistance of the vitreous Membrane,

Membrane, and also the Help of its own thin Membrane: But these little Membranes, and the Bodies bound or confin'd therein, are so pellucid and fine, that they are plainly transparent; yet Reason teaches us, they are made up of their smallest Vessels, and *Ruyseb* hath made them evident in the greatest of Animals the *Whale*.

At length the medullary interior Part or Portion of the optick Nerve, enters into the bottom of the Bulb of the Eye; so that the Place of this Ingress by reason of its Altitude or Heighth is in the middle, but on Account of its Latitude it is so situated, that it scarce sticks in the third Part of distance from the internal Angle of the Eye, measuring the Diameter of the Eye breadthways. From whence the optick *Axis* does not fall in the Place of this Ingress, but recedes much from thence towards the exterior Angle. But this *Medulla* being enter'd in, by and by expands it self in the bottom of the Bulb, rising on every side under the *Vitreum*, at the Ingress of the larger Arteries, stretching together with that, it is fill'd up and encompass'd; the Remainder that lodges there like a tender thin *Mucus*, is call'd the *Tunica retina*.

The Cavity of the Eye form'd from the hollow *Cornea*, and the Convex Superficies of the vitreous Chrystalline Body, is full of a thin, pellucid Humour, tasteless and void of Smell, presently growing up or filling again; and therefore is soon exhaled, extending and preserving the flaccid *Cornea* into an equal Convexity; sustaining the *Uvea* suspended, most liquid in Youth, by little and little growing more opake, thro' various degrees, often turning to white in Age; it seems to arise from the Arterial Blood, prepared in the *Choroide* and the Arterial Rings of the *Iris*, and perfectly elaborated from the vitreous Humour; from whence being farther attenuated in the Arteries, from which the smallest
Lym-

Lymphaticks arise; afterwards transuding thro' their open *Foramina* on all sides, in the internal Superficies of the *Cornea*, *Iris*, *Uvea*, vitreous Membrane, and the tender Chrystalline one into this Cavity; from thence it is perpetually reabsorpt by the open Mouths of the lymphatick Veins, without leaving any *Fæces* at all behind; to which Work *Nuck's* Ducts and those of others are useless here; therefore it is most serviceable in this kind, for preserving, moistning and lubricating this tender Part, and continuing them in a pellucid State or Condition.

The solid Chrystalline *Lens* or Humour, being spherical on both sides, is form'd or compacted of innumerable spherical fibrous Segments, strictly united and pellucid, thicker or closer than the aqueous and vitreous Humour posited in that place, where the *Axis* of Sight passes the Centre thereof, and makes its *Axis*; nearer to the *Cornea* than the *Retina*, consisting of a vast Number of Vessels, as the Dryness, Loss of Weight, and Contraction of Body teach; this is improperly call'd the Chrystalline Humour; it seems to receive Vessels to it self, from other continued ones.

The vitreous Body also is most pellucid, and yielding, thicker than the aqueous Body; on every side Vascular, as the Humour flowing out of a Puncture and the Dryness thereof teach: Hence likewise it undoubtedly consists of a circulating Humour, of contracted crooked or bending Fibres, of a depressed Ring elevated in the middle, hence raised gently from the Chrystalline, brought to the *Cornea* made from the remoter *Retina*, restoring it self by the relaxed Fibres in that Ring, and subsiding in the middle, it performs its Function at the bottom of the Eye, the Chrystalline being slowly drawn to it.

The Eye being thus fabricated, and placed in its Orb, receives a Membrane from the Fore Part that is lax and moveable; arising from the *Periostrum* out of the external Circumference of the *Orbit*, which is a vast vasculous pellucid Covering, for the whole Fore Part of the Eye, by which the Bulb thereof is confirm'd in an easie natural Motion.

Then the four Muscles, *Cowper* mentions from *Bidloo*, arising carneous from the Circumference of the greater *Foramen* of the *Orbit*, ascending about the Bulb, growing tendinous about the middle, so fix'd into the *Scelerotick*, and being connate to that, they elevate and depress the Eye, bring it to and lead it from the Nose, they roul, compress and elongate, as single, or as they act in various Motions. From thence the superior oblique Muscle arising from the bottom of the *Orbit*, towards the *Attollens* with a carneous Beginning, furnish'd with a carneous Belly in its Progress, is chang'd into a round Tendon, which passes thro' a cartilaginous Pulley, betwixt the anterior Parts of the *Orbit*, towards the Nose, from thence going back again, the Bulb is inserted in the middle Place betwixt the *Attollens* and the Ingress of the Optick; so makes it that the Bulb carryed round, towards the Nose, about its own *Axis*, may be led outward from the *Orbit*, and the *Pupilla* likewise may be turn'd downward. But the Inferior oblique Muscle being carneous from the exterior, in that inferior Part of the *Orbit*, which joyns here the Bones, arising betwixt the *Abducens*, and the optick Nerve inserted with its Tendon; makes it that the Bulb being turn'd round towards the exterior Angle, to direct the *Pupilla* from thence, and also carried upwards, the whole Eye may be drawn beyond its *Orbit*: But if these two act together, they set the Eye tuberant towards the exterior Parts from the *Orbit*, and render it fit to see into all the fallacious Objects that are near it on each

side: Lastly, by making use of the Motions of the four former Muscles, they make the Eye hang easily in the Orbit.

Furthermore, that the *Modus* and Place of Sight, or Vision, may be determined to this known Structure of the Eye, all those Things shou'd be apply'd which have been demonstrated in *Opticks*, *Catoptricks*, and *Dioptricks*, which have been so much improv'd by Sir Isaac Newton, who is a Man of so vast a Penetration, that he seems to have arrived to the utmost Perfection of human Wit, in Mathematicks and Philosophy.

Light, of all collected aggregate Colours, turn'd every way emits the most subtil Rays, but such as are compounded again, of all sort of Colours, hence being divisible again into simple ones; which by themselves or variously collected make various Colours, but all united together, ones splendid, lucid Brightness, or shining white Colour; these Rays of Light from the lucid point as the Centre, posited outwards towards all points, by right Lines, in a homogeneous *Medium*, without knowing any Interval of time, pass thro' and becoming pellucid, rush into opack Objects; and therefore arrive also at all points of the *Cornea*, which are continu'd within the *Cone*, which is made in the lucid point, as the *Apex*, in the plane of the *Cornea*, as the *Basis*, if shining between the Point and the *Cornea*, no Impediment interposes.

The same Rays approaching nearer to harder Bodies, being made curved from thence, some more, some less, are thus separated; being separated and reflected they produce various Colours, from a false, reflecting or repelling Body, except that they are separated by its force; this various Reflexion therefore, according to the variety of Colour latent in the *Radius*, but yet in the Reflexion appears to be the same Angle of the reflexed and incident Ray, with

with the erect Perpendicular from the Place of Incidence, neither does there seem to be here made any change of the rest.

But if those Rays fall in from one *Medium* to another, they are afterwards curved about the approaching ones, forasmuch as the like proceed by that *Medium*, from as much as the posterior Body is denser, the Rays are so much the greater towards the perpendicular, and so on the contrary; and also from a particular Cause latent here in some Fluids, tho' not determin'd by Experiments themselves; and this Inclination is call'd *Refraction*.

But that is plain to the Senses from this certain Law; the same *Radius*, if it hath fallen on the same pellucid *Medium* by various Angles, will be as the *Sinus* of the Angle inclining mutually to it self, and so also the *Sinus* of the refracted Angles.

Hence therefore the Rays, from the shining or reflecting point to the pellucid *Cornea*, are diminish'd or lessen'd by that means to the perpendicular, almost by the same Alteration of Course, as in the Water; so they proceed by the aqueous Humour, and are determined as they pass by the *Foramen* of the *Pupilla*, on the Superficies of the Chrystalline Humour, but those which enter in by such Obliquity, as they fall upon the *Iris*, from whence reflected they slip out of the Eye again, least being reflected and entring the Eye together, they shou'd confuse the Distinction of Sight. And there are others, which by their Obliquity flowing into the inferior *Uvea* and vitreous Body, or into the Superficies of the vitreous Body, are also so immediately suffocated in the black Colour there, as if there had been no Rays at all, so that no other can be transmitted thro' the vitreous Humour, except such as penetrating the *Pupilla* fall into the Chrystalline

line Humour: The *Iris* being in the mean time contracted or dilated, admits more or less Rays, according as the Object is livelier, or more languid, nearer or farther off: Whereby the luminous Object, constringing from thence the *Pupilla*, as the Object is nearer, the *Pupilla* is the more contracted, and so on the contrary wise, according to the former Description of this Machine, which defends the tender *Retina*, least it should be injur'd, dry'd up, or consumed with Heat.

The *Cornea* therefore as it hath a plainer Figure, compells the Rays as they pass from one lucid Point; and so spreads them the more about, from whence fewer of 'em reach the Chrystalline Humour, and those that do are much divided, except they come from a pretty remote Object; but as that is rounder, it more unites the Rays as they pass from one point, and by that means collects more of them in the Chrystalline Humour, from whence may be understood one reason of the Sight of pore-blind and old People.

The Chrystalline Humour collecting more determinate Rays, received from the *Pupilla* by a new Refraction, renders them converging, by which means, those that arise from one point out of the Eye being here again, collected into one point not very distant, may be pass'd thro' the *Vitreum* to the *Retina*, and there describing that one single point only precisely, from whence those Rays will follow; if the *Chrystalline Lens* is too thick or round, then the Point of Collection being too near the Humour, there happens a Confusion of Sight, if too lax or plain the remoter Point is stricken, from whence again proceeds Confusion: And this is another Reason of the short or distant Sightedness of such as are *Pore-blind* or *Old*.

Therefore why *Pore-blinded* Persons are assisted by a hollow dioptrick Glass, or the Nearness of the Object?

ject? And why old People see better from a Convex Dioptrick Glass or the Distance of the Object, is plain from what hath been said before? But these Vices are remedied, by the Adduction or bringing to of the Chrystalline Humour to the *Cornea*, or removing of it from thence, which seems to be done by two different *Mediums*: To wit, by compressing the Bulb of the Eye by the four Muscles contracted together, hence making it longer; or from the Contraction of the Fibres, compressing the *Vitreum* and raising the Chrystalline Humour; neither does there any other Cause appear.

Refraction from the Air upon the *Cornea*, is almost equal to that, which is made from a Ray of Air, let fall upon the Water, which from the Aqueous Humour upon the *Lens* appears equal to that, which happens to the Ray, acting upon the *Vitreum* from the Water, from whence it alters little: Lastly, that which is seen, while from the Chrystalline Humour on the vitreous Body it changes but in a small measure, and from the stricter Compression of the vitreous Humour perhaps scarce differs, till that Body is made thicker, from whence there seems to be at first, that Necessity of the vitreous Humour, that the *Lens* being able to be moved freely or without Constraint, it may fitly accommodate the Eye for various distances; while at the same time that very Mass of the Chrystalline Humour is more constant to its Figure, than the vitreous Body.

From whence the whole *Apparatus* produces this, that in the bottom of the Eye, directly under the *Pupilla*, there is made a distinct and lively Collection of those Rays, which proceeding on from one point of the Object, and entring into the Eye, penetrate the Chrystalline Humour, and so strike so many points on this bottom, as may be conspicuous in the Image, from whence the like little Images from the Object are painted in the *Retina*.

Of Seeing.

For since the mucous *Medulla* of the optick Nerve, lodges precisely in this Place, directly under the *Pupilla* and the Chrystalline Humour, it is plain that is the Part, which receives the Pictures or Images, and brings them by a Continuation of this Impression to the common Sensory, and excites or raises an *Idea* of the thing seen to the Mind.

Hence according to the Experiments of *Picard* and *Mariot*; we ought to praise that infinite Wisdom, which hath placed the Ingress of the optick Sight, not in the *Axis*, neither towards the exterior Angle or corner of the Eye, but towards the Nose in the middle Altitude.

Therefore the Perfection of Seeing depends on that Figure; the Pellucidness, Structure and Energy of the Solids, and on that Density or Thickness and Pellucidness of the Colourless Humours; from which many Rays from every visible Point of the Object, mix'd with no others, are collected into one distinct point of the *Retina* made by this Heat, neither too distant, or too near; thence from the Motion of both those, from the Objects clearly and distinctly placed in a various distance, it is equal in Distinction, for so Size, Figure, Distance, Situation, Motion, Rest, Light and Colour are best represented; from whence that Situation is express'd in the *Tunica Retina*, and that Expansion and Proportion betwixt the Medullary, Arterial, Venous and Lymphatick Substance, which brings the pure Images freely thro' the optick Nerve to the common Sensory.

The Rays therefore shine, not from our selves, neither are they again reflected from the Objects into our selves, as the *Stoicks* asserted; neither do we see from a visible Species sent from the Objects into us, as the *Pythagoreans* said; and scarcely from the *Effluvia*, emitted from the Object and the Eye, made before mutually embracing each other, and from thence reflecting, as the *Platonists* argued; and lastly from
no

Of Hearing.

no material Emanation of corporeal Images, as *curus* thought; but from the Laws of Mechanicks, as we have explain'd them in the human Body, to the better Understanding of which the curious *Jacob Ravi of Amsterdam* hath much contributed by his accurate Description of the inward Organ of the Eye.

Why do the Objects placed at the smallest distance, which the Eye can carry, that it may be distinctly seen, appear so clearly?

Why being remote they appear so distinctly at a great distance, tho' they seem weaker? Why do they look so confus'd? What is requisite to a distinct, and what to a strong Sight? &c. all these things are easy from what hath been said.

Of Hearing.

Sound is a tremulous Motion of the common Air, arising from a sonorous Body concussing it, by a reciprocal Shaking of its sides. The Propagation thereof is made from the sonorous Center, first of all, by right Lines in the Circumference of the Sphere of its Power; and by that Law making its Progress and Reflection, which it obtains in the Rays of Light; only that its Propagation is made successively, to wit, it performs 968 English Feet in the compass of one Second of a Minute; less or more it is equally swift as it is spread abroad by a contrary Wind, which yet is less extended; it impresses its Tremblings from the elastick Bodies, but the elastick Bodies reflect or turn those back scarce alter'd; but Hearing is the Perception of a Sound rais'd in the Mind, by the assistance of that Organ, call'd the Auditory Organ or Ear.

Hence therefore it is known, saith *Valsalva*, first that the smooth Membrane of the external Ear, firmly stretch'd upon the thin, elastick, tremulous

Cartilage, adhering to the cartilaginous *Basis* of the *O. Temporum*, reflects strongly, the sonorous Rays received, neither stopping nor changing them.

But the Figure of the external Ear, hath several things worthy Observation in it; for the Eminence or Rising thereof, saith the foresaid Author, is remarkable, being placed above both the Temporal Bones, so that scarce any Rays of Sound can pass by both Ears together. But the three spiral *Plicæ* or Foldings of the Ears, by their Fabrick, Position, Subordination, Inclination, Winding or Turning, make it from the sonorous Point of the sounding Rays sent out, they are plentifully enough received and reflected back pure and uncorrupted from either or both Ears, but from thence being united together they are driven, saith *Duverney*, into the exterior *Concha* or Shell of the Ear.

But the opening Cavity of the *Concha* being elastic and free, is form'd with two Muscles, by the Action of which, it is fitted to expand and yield to the various Motions received by it; so that being thus dispos'd, it may be capable of uniting the Rays close together, or dispersing them wider, and consequently accommodate it self, so as to temper or allay strong Sounds and increase the weak, as is most necessary.

But the Auditory *Meatus* or Passage, consisting, according to *Valsalva*, of a Tube partly cartilaginous, partly osseous, cloath'd with a like Membrane, by degrees finer and very nervous, being defended with a little viscid Water and Ear-wax, transuding from the Glands seated underneath, being very fit for conveying the Sound unhurt towards the inward Parts; but the Obliquity of that increases the Superficies in this Canal, and multiplies the Places of their Reflections; also the cartilaginous, triangular Tongue being tremulous and erect in the hollow of the Ear, but especially in the Orifice of the *Meatus Audi-*

Auditorius, from the Region placed before, furnished with a Muscle, by an egregious Methanisin, makes it, that all the pure Rays are determined between the *Meatus*, neither do they issue forth however they are reflected : The Figure of it is tubulous, *cylindro-elliptick*, ascending and descending by a Serpentine Progress, and by its Ascent again terminating in the Membrane of the *Tympanum*, increases its Sound and Reflection, and makes it, that all the Rays run into the middle Center of its collected End, at the same time hindring its Clangor.

The Membrane of the *Tympanum* agreeable to *Duverney*, being supply'd with a threefold *Lamella*, saith *Ruyfch*, the middle of which is almost wholly vasculous, the outward ones have scarce any Vessels, so obliquely seated, that it inclines to the upper Parts of the *Meatus*, running out from the inferior, hence forming on the superior Part an obtuse, on the inferior an acute Angle with the *Meatus* ; so it more increases the Superficies, than if it was placed perpendicularly, hence it makes a larger Place for more Rays of Sound to flow in, and therefore it multiplies the tremulous Concussions ; but first it occasions, that the Rays meet, especially into the middle Center of this Membrane, that it may easier shake ; but since the exterior membranous *Lamina* are raised from the Auditory *Meatus*, from an intimate Membrane surrounding the *Tympanum* ; hence it is plain, that Membrane communicates the less, with the external and internal Ear.

Hence the strict Application of this to the Border of the bony *Meatus*, the Thinness, Dryness, Looseness thereof, the hollow Figure on the Part of the *Auditory Passage*, but *Convex* on the Part of the *Os petrosum*, the Application of the *Malleus* to this, teach us, that this Membrane straitens the Ingress of Air, from the *Auditory Passage* into the internal Ear ; while the *Sordes*, excrementitious Humours, Insects, Dust and the

the like are invellop'd in the Ear-wax, and by the excited Motion of Titillation, first, from small Hairs growing there evacuated; the sonorous Motions are transmitted to the interior Parts; and perhaps here is something perform'd of Dullness of Hearing.

Duverney says, the strict or close Application of the *Malleus* to the Membrane of the *Tympanum*, even almost to the Center thereof, with an extended Haft or Handle, while at the same time the moveable Head in the bony *Sinus*, and in the other Superficies of its Head, being furnish'd with two Tubercles in each Cavity, is set together in the Articulation with the two Cavities, and one Eminence of the Body of the *Incus*, here suspended at Liberty; the artificial Insertion of three Muscles into this *Malleus*; for first of all here is, according to *Aquapendent*, *Cowper*, *Bidloe* and *Casseri*, the external relaxing Muscle of the Membrane of the *Tympanum*, which arising from a carneous Beginning out of the upper Part of the external Margin of the bony Auditory Passage, ending in a Tendon, running under the glandulous, ceruminous Membrane, it ascends with its Tendon to the upper Parts of the Membrane of the *Tympanum*, where it passes by the *Sinus* left there in the Border of the osseous Ring, entering with its Tendon into the internal Shell, and descending even to the Tubercle of the *Malleus*, is there inserted betwixt the sinking and rising *Apophysis*; from whence it is evident from the Action thereof, that the *Malleus* and Membrane of the *Tympanum* are drawn towards the Auditory Passage, and from thence lead the Membrane to a level or evenness, and Extension; in the second place, here is found the external Muscle of *Duverney*, which arising tendinous from the external Part of *Eustachius's* Passage lying carneous thereto, ascending upwards it enters the back Cavity of the *Tympanum*, form'd in the oblique *Sinus*, engrav'd upon the bony Margin of the Mem-

Of Hearing.

Membrane of the *Tympanum*, it inserts it self to the slender *Apophysis* of the *Malleus*, especially produced in the long, slender, flexible, elastick Process, which *John Jacob Raw* hath discover'd here from his commendable Industry, and to which from the broad Application of the Fibres he hath taught, this Muscle is united undoubtedly for an admirable Use, to wit, that from its innumerable Determinations, it might lead the thicker Part of the *Malleus* and the Membrane of the *Tympanum*, towards the Auditory Passage. 3ly, The internal Muscle of *Eustachius* is discover'd by *Duverney* and *Valsalva*, which arising with its Fibres from the foreside of the Cartilage of *Eustachius's* Passage, thence contain'd in the *osseus Semi-canal*, running out laterally at the superior Part of *Eustachius's* Passage, leaving that with its Tendon emerging near the oval *Fenestra*; reflected as it were about the bony *Trochlea* or Cavity of the Ear, it is inserted to the *Malleus* of the same, at the back part under the Insertion of the external Muscle of the *Malleus*, by the help of this Muscle being contracted, the *Malleus* is drawn, and the Membrane of the *Tympanum*, stretch'd towards the *Oss. petrosus*, and the concave Membrane restored; I say, all these things teach us, that the *Malleus* as a Lever apply'd to the Membrane of the *Tympanum*, in the moment of Motion, resting, or leaning upon the *Sinus* of the hollow'd Margin, as on a fix'd Basis, to sustain its Rotation, stretch'd by the assistance of one, two or three Muscles, may first extend or remit the Membrane of the *Tympanum*, render it convex, or make it plain, direct or drive it different ways, hold it suspended, thro' various Degrees and various Directions. 2ly, For this reason it may alter the space of the internal Cavity of the Ear to draw in, expell and compress the Air, just as the Passage of *Eustachius* is open or shut. 3ly, Hence the Membrane

brane of the *Tympanum* is adapted for the Reception of the harmonious Concussion of Sounds, communicated from tense Bodies, and easily bestow'd upon the *Incus*, as Mathematicks teach us.

The Body of the *Incus*, saith *Duverney*, articulated with the *Malleus*, resting on the *osseous Sinus* at the *Malleus*; and free Suspension of its short Process from the suspensory Ligament, in the upper posterior Cavity of the *Concha* or Shell; the Connexion of its longer Process, with the little orbicular Bone; the Articulation of this with the tip thereof in the hollow of the *Stapes* or *Stirrup*; the Uniting of the Elliptick Basis of the *Stapes* with the Membrane of the *Foramen ovale* demonstrate, that the Concussions impress'd on the sonorous Membrane, by the help of the four little Bones, cover'd with their vasculous *Periosteums*, according to *Ruyseb*, and joyn'd together by Articulations, saith *Valsalva*, suspended or hung at liberty in the great hollow of the *Concha* agreeable to *Duverney*, constantly lubricated with an exuding Humour, by which means Sounds may be communicated without Injury even to the Membrane of the *Foramen ovale*, and be impress'd thereon as such.

By this notable Artifice again, the *Stapes* may be stretch'd here, and the Membrane of the *Foramen ovale*, by the assistance of the Muscle of the *Stapes*; which is raised from a carneous Body from the osseous Canal, stamp'd on the *Os petrosum* at the bottom of the *Tympanum*, thence descending by a fine slender Tendon, it is knit to the Head of the *Stapes*, and by drawing obliquely, it depresses one and raises the opposite Part of that little Membrane.

Therefore Sounds unhurt and unchang'd, belong to this Membrane, but yet may be from this *Apparatus* extended to infinite degrees; hence therefore it is so apt to receive such an infinite diversity of Concussions, that contrariwise make the like
Vibra-

Of Hearing.

Vibrations ; and communicates them as such to the hollow of the Labyrinth, which being shut, covers the *Oval Entry* or Window.

The broad internal *Concha* or Shell, like an Elliptick Body communicating into the cellulous Cavities of the *Mastoide Process* ; by *Eustachius's Tube*, partly bony, partly cartilaginous, gaping with an open Mouth towards the Palate, being shut by a cartilaginous semilunar Margin, having a Communication with the external Air, which is drawn in from the Nostrils or Mouth, makes it, that first, the Air can go this way into these Places, there to remain, be rarefy'd, pass'd out, renew'd and compress'd : 2ly, That it can be so reduced to a Temperament with the external Air. 3ly, That the sonorous Rays admitted thro' the Nose or Mouth, entering in hither, may expedite or assist the Hearing, when the *Auditory Meatus* is hurt or injured. 4ly, Because all those Places may be invested or cloth'd with a vasculous Membrane, here is a soft, lubricated Texture of Parts, that the Expurgation of all those Contents may be preserved.

But while the round *Foramen*, saith *Duverney*, being shut by a thin tense Membrane, lying open into one part of the Scale of the *Cochlea* ; as it were in the Pan or Socket of this elliptick Space, placed in a contrary Center to the Membrane of the *Tympanum*, it forces those sonorous Rays into this Membrane : To move the Cavity of the Scale, and the Contents thereof, by communicating the airy Tremors or Concussions, yet perhaps not so accurately and distinctly as those are, which by the Help of the Membrane of the *Tympanum*, and the little Bones are impress'd on the Membrane of the *Foramen ovale*.

Whether the *Meatus* or Passage of *Eustachius*, be opened by the Action of the internal Muscle at the same time, in which from the Application of the

the Membrane of the *Tympanum* in this Operation, the Cavity of the interior Shell is shut? Whether the Mouth thereof about the Palate be shut, from the drawing in of the cartilaginous Valve by the Contraction of the Muscle *Cephalo-pharyngeus*, hindring the Entrance thus far of the Aliment in swallowing.

But notwithstanding *Duverney's Foramen ovale* opens into the hollow *Vestibulum*, or Entrance being fill'd, partly from the medullary Portion of the Nerves, which entering the *Foramen* from the Auditory Nerve by the internal Superficies of the *Os petrosum*, brought to by the smallest Holes made in the *Vestibulum*, being there distributed, dispos'd and confirm'd by three semicircular bony Canals, and as is observed again, they are seen to go out medullous; partly from the medullary Portion of a soft Nerve out of the foresaid *Foramen*, entering the *Apex* or very tip of the *Cochlea* by many small Holes, and from thence distributing little Filaments or Threads by the upper spiral Passage, from whence bestowing the soft Pulp on the *Vestibulum* under the oval Membrane; I say, it appears from these, that the sonorous Rays by this shaking Membrane, are carried together with the Help of those concussing Nerves, to the common Sensory, and there raise the *Idea* of Sound.

But the Fabrick of the spiral Cavity of the Ear call'd the *Cochlea*, seems form'd beyond all Admiration; while undoubtedly the osseous Canal being conick, is bounded about the bony Cone from the *Basis* thereof upwards from its *Basis* with two perfect spiral Windings, with one half from its tip to the tip of the Cone, being in the *interim*, every where divided from the *Basis* to the tip, even thro' the triangular *Septum Medium*, accurately into two separate equal Parts; which *Septum*, in the nearest Part sustaining the Cone, is osseous, smooth, tremulous and elastick in the outward Part, in respect to the Strength.

Strength of the Cone membranous and nervous, partly fixed to the preceding bony Part, partly to the bony Canal; so that these two Passages communicate nothing, nay the Mouth of the Superior lies open into the *Vestibulum*, but that of the Inferior is shut by the Membrane of the round *Foramen*; while in the mean time the little slender Nerves are seen every repairing to this Place.

For by this Artifice it is brought to pass, that in this *Lamella*, from the determinate *Basis* ending in a point: infinite tremulous Cords equally stretch'd, may be distributed; and therefore there are always amongst them innumerable quantities, which tremble or shake in an harmonious Consent with every Sound, and from thence may represent that, and can bring it as such to the common Sensory; for which reason therefore that acute Distinction of different Sounds, is perform'd by the Help of the oval Membrane, while from the Motion of the round Membrane, there is a simple Perception as it were only of a murmuring or humming Noise communicated which excites Attention, and in the same manner likewise stretches the bony Organs, as they are fitted to that which is heard by distinguishing.

But whether the extreme Filaments of those small Nerves exercising their Office or Function, and being distributed by these Labyrinths, return again into the *Cerebrum*, and so to the common Sensory? Certainly there are infinite Numbers of Questions remain to be inquired into.

As, why the Hearing is quicken'd by applying the Hand to the hollow of the Auricle, towards the Sound; and why on the contrary, when the Auricles are cut off, the Hearing is dull?

Why is the Hearing increas'd if the Plane of the Ear be turned from the Sound, to the Obliquity of Forty Five Degrees.

Why

Why is the Hearing clearer upon the Mouth being open, and the lower Jaw hanging?

In crying, yawning, quick speaking or singing, why is there a Noise in the Ear and a Dulness of Hearing?

Why do deaf Persons, holding a creaking Body, in their Teeth, perceive the Noise it makes?

Why do they often hear better by speaking into their Mouths?

Why is there Deafness, if the opening of *Eustachian Tube* be any ways obstructed? Why the same from the Membrane of the *Tympanum* being broken?

What way do some emit the Fumes drawn in at the Mouth into the Ears?

Whence is it that in two Ears, there is but one sound, and that without Confusion? All these things may be found resolved in *Bartholomæus Eustachius*, *Julius Casserius*, *Fab. Aquapendent*, *Shelhamer*, *Duvernoy* and *Valsalva*.

Of the internal Senses.

FROM all these things we know, that our Bodies receive nothing else from sensible Objects, that may make the Senses, than an Alteration excited in the Superficies of the Nerve by the Touch of the Object moved; which is produced from the Figure, Size, Hardness and Motion of the sensible Body changed; so that it is probable, that the most different sensible Bodies if they were the same in these Four, they would raise the same Sense in the same Organ.

Neither is this sufficient; but it is requisite that that Change be propagated by an unconstrain'd Nerve, even to some Place in the *Medulla* of the
Cere-

Cerebrum, from a single Nerve also into a particular Portion of the *Cerebrous Medulla*; which we are taught is so from Ligatures, Wounds and Contusions of the Nerves of the Brain. But this Change is received there so small and that so simple, that nothing scarce is simpler; and certainly without that Simplicity it can scarce be examined or explain'd.

But in the mean while, according to the Variety of the Object, the Diversity of the Nerve affected; the Distinction of the fabricated Organ of Sense, according to the Variation of the Place in the *Medulla* of the Brain, from whence that Nerve proceeds, the different degree of Motion, by which the Action of the Object is apply'd; there arises in the discerning Intellect, an *Idea* perceiving variously and representing nothing that is in the Action of the Object, or in the Passion of the Organ; but yet the same *Idea* always follows the same Action of the same Object into the same Organ; from whence the Connexion of those *Idea's* follows the same Disposition of the said discerning Organ, as if the conceived *Idea* had been the effect of the Action of the Object upon the Organ.

Therefore this Diversity of *Idea's* does not seem to depend only from that Variety, from which the extreme Part of the Nerve is made; but from many others besides, not indeed Causes, but Conditions from the Institutions of the adorable Creator.

The *Idea's* oftentimes while they are perceived in the Intellect, likewise raise in this Representation Joy or Sorrow, or neither; these Indifferents produce Love or Hatred towards that Object, from the Action of which that *Idea* was excited.

But we are so form'd, that this very Condition of the Mind of Love or Hatred, stirs up in the Body such like muscular Motions, by the assistance of which the Object of Joy can be united to the Body

or the Thought, or whose Efficacy can remove that so, that the Sorrow attending the Presence of it may be blotted out.

But since those muscular Motions, by the Help of the Spirits puls'd from the Brain into the Muscles are perform'd, hence it is plain that from every Point of this to the very Muscles obnoxious to the Will, there is a free uninterrupted Motion of the Spirits arising from the Brain; from whence the common Sensory is part of the Brain, where all those collected Points meet together; and therefore it is evidently the *Medulla* of the Brain in the Head.

As the Action of the Object is more distinct in the common Sensory, the *Idea* arising from thence is clearer and distincter.

By how much the Action of the Object is livelier in the common Sensory, the *Idea* rais'd from thence is the clearer.

The oft'ner the Action of the Object is renewed in the common Sensory, the *Idea* from thence is the brighter.

The more foreign the Action of the Object is from all others in the common Sensory, and by how much the more unused, by that means the *Idea* becomes more lively.

If therefore the Condition impress'd from the common Sensory, so strongly adheres, that it cannot be chang'd from the supervening Action of other Objects, the present *Idea* will remain as the Companion of that Condition. Or at least from the Occasion of the Cause or accessory *Idea*, the same *Idea* is restored to the Will; but if the like Conscience of what was formerly conceiv'd attend, it is call'd *Memory*.

But all this depends only on that simple Condition of the common Sensory, which is there only a mere mechanical Disposition.

Where-

Wherefore it may arise equally from corporeal Causes in the Body, wheresoever latent; affecting after that manner the Nerves, Spirits and Brain, hence exciting the same *Idea's*; and this Disposition is call'd the first Imagination.

If then the Memory of such an *Idea*, acting by reason of some external Object formerly raised, be so strong, and also the present *Idea* now depending on the internal *Sensations* be so lively, it is the strongest Argument that the present Cause of this is now out of the Body, which is called the second Imagination.

If the Will in the common Sensory, and in the Parts efficaciously cohering to it, retains that Condition, which arises from the Action of a distinct and lively Object; or if it stops the Actions of all the other Objects, and keeps only the former, this Action of it is call'd *Attention*; from the effect of which, there is a distinct, clear and sprightly *Idea* that lasts long, and therefore may be call'd the Mother of *Science*.

From which are understood both those, commonly call'd the five external Senses, as also those internal ones, nam'd the *Memory*, *Imagination*, the *Affections of the Mind*, *Attention*; with which, *Hunger* and *Thirst* us'd to be reckon'd by some; from whence also, may be known the reason of many Enquiries about this Affair; as,

First, Why Corporeal Signs, having nothing besides the Will of the Institutor, so produce, direct, and change *Idea's*?

Why it is impossible to correct a second Imagination by any reason, but with violent Motion?

Why, one with another, the external and internal Senses flourish, voluntary and muscular Motion ceasing?

Why Attention, Remembrance and Imagination lull asleep the external Senses, and suppress the Motions of the Body?

64 *Of Waking or Absence from Sleep.*

From what reason does such Weakness happen to the Body, where the internal Senses are vigorously and long exercis'd ?

But from what reason do various Objects so often exhilarate ?

Why do Meat and Drink, Medicines, Poison, Rest, Motion, Air, Heat, Cold, Custom, Affections of the Mind, perform such Power in all this ?

Of Waking or Absence from Sleep.

THAT Person is call'd Waking, in whom the Organs of external and internal Sense, as well as the Instruments of voluntary and involuntary Motions are in such a Disposition, that they can easily exercise their usual Motions : Which wholly depends on the Presence of the Spirits that are good and plentiful, in the Brain, its *Medulla*, Nerves and Muscles, as also on the good Condition of the solid Parts constituting the Brain, Nerves and Muscles. Therefore Waking is said to be that State of the Body, in which these two are in this Condition.

Of Sleep.

BUT the Knowledge of *Sleep* is much more obscure, tho' it is only the opposite State to Waking, from whence there will be occasion, towards the understanding of its Nature, accurately to weigh all its *Phænomena*, which are these.

First, Falling from Waking into Sleep, they begin to be seiz'd by degrees; and exercise all their Senses external and internal with Difficulty, and also with a Sense of Weight in the Body, and at last they rest altogether.

2ly, They

Of Sleep.

2ly, They begin to rest by degrees, from thence to cease with a Sense of great Resistance, to give over all voluntary Motion.

3ly, But the Muscles appointed for exercising, or performing these, fall, flag, decay, and grow paralytick; first of all, appearing in the Eye-lids, Face, Neck and Arms, and so by degrees extend over the whole Body.

4ly, All these corporeal Effects, and the Affections of the Mind cease, which are succeeded from these Three, as from a Cause.

5ly, Yet in the *interim*, the Motion of the Arteries, Veins and Heart, is stronger, slower, more equal and fuller, increasing thro' various degrees, as Sleep comes on.

6ly, Respiration is deeper, stronger, slower, equaler, coming on gradually, and growing greater as Sleep increases.

7ly, All those things therefore, which are made from these Two are perfectly perform'd; from whence is brought about that Perfection to the Blood, which is required to the best Circulation, Concoction, Secretion, Perspiration, Distribution and Nutrition; and makes first, the Motion of the Humours quicker thro' the sanguiferous Vessels and near to the Heart, but slower at a distance therefrom, and otherwise excited thro' the voluntary Muscles.

8ly, The sleeping Man wakes from the external Sense, being very much stirr'd up by the Object, or from an inconvenient Perception of Pain, or from a Disturbance occasion'd by too great a Compression of the Part, or else of his own accord; otherwise the more any one sleeps, the more sleepy they will be, till at last Life becomes one intire Sleep.

9ly, The waking Man first loos'd from Sleep, opens his Eye-lids, stretches his Limbs, yawns and

returns to Rest awhile, till being refresh'd, he recovers his Strength again.

But Sleep is procured, cherish'd and increas'd in us; first, by solid and tenacious Food, too much eating, and Stoppage in the Stomach.

2ly, From too plentiful Drinking of vegetable fermenting Liquors, being the more somniferous, as they abound more in Spirits.

3ly, From penetrating, flagrant, spirituous Aromatics, from Saffron, Clary, Sage and the like, in which there is no obstructing Acrimony.

4ly, From Poppy, Hounds-tongue and Lettice-juice, the Mandrake Apple, and the Virtue of Nightshade.

5ly, From a great Weariness, by a long continuance of Labour.

6ly, From the Quiet of a contented Mind, and a lazy Tranquility of an unactive Body, and an absolute Retirement from all sensible Objects.

7ly, From Excess of Heat or Cold, or it proceeds from some common Cause, whether from Temperature or Age.

8ly, From every such Cause which hinders the Arrival of the vital Blood into the Cortex of the Brain, and its Passage thro' the Vessels thereof, the Secretion of the Spirits so necessary for that Use; the Derivation of them into the Nerves, the Organs of the Senses, and the voluntary Muscles; the Reflux of those Spirits from all these Places, towards the common Sensory; hence comes Two Evacuations, apirituous Disposition of the Humours, a Plethora that is urging, Wounds of the Brain with a Phlegmon of it, Apostems produced there, Extravasation of Humours under the *Cranium*, Contusion of the Brain, its Compression, Ablation, Putrefaction, and many others of the like nature.

In the next place, Sleep is disturb'd, first from a perpetual, slow Mixture of a wat'ry or warm Liquor with the Blood.

2ly,

Of Sleep.

2ly, From a Vellication of the *cerebrous Nerves* by some *Acrid*.

3ly, From a strong Affection of the *Mind*.

4ly, From the *Brain* being irritated by some external or internal Cause.

Therefore *Sleep* will be that State of the *Medulla* of the *Brain*, in which the *Nerves* receive not from the *Brain*, either so plentiful or so strong an *Influx* of *Spirits*, as is required from thence, that the *Organs* of the *Senses* and those of voluntary *Motion* may easily and expeditiously perform their *Actions*.

But the proximate Cause of this is perhaps the penury of a subtil Spirit, elaborated only with much more Ease and Quiet, and so wasted or consumed upon the Parts; from whence the little empty Vessels for a time flag and are scarce inflated; or there is such a Pressure of the grosser Blood at the *Cortex* of the *Brain*, that hence the *Medulla* wrapt round by the *Cortex*, wants compressing to assist the Passage of the *Spirits*.

And the natural Cause of *Sleep* is every thing that can produce these two: From whence the Effects thereof are understood; for in *Sleep* some Actions cease, the *Organs* of these and the *Muscles* are at rest; the *Spirits* scarce flow thro' them, therefore they are less consumed or wasted; but the solid *Villi* and *Fibres* in the *Nerves* and *Muscles* are scarce chang'd; it obtains an *Equilibrium* in all the Parts; neither is there a variety of Pressure in the Vessels, or that Diversity of Swiftneſs in the *Humours*.

But in *Sleep* the Motion of the *Heart*, *Lungs*, *Arteries* and *Viscera* is increas'd; neither is it here so alter'd or destroy'd, by the Action of the *Senses* or voluntary *Motions* then ceasing: Therefore these Effects are produced, which depend immediately of them, and may be judg'd: 1st, The stronger and more equal Circulation of the *Vital Humours*, thro'

Canals then more free and lax, lying open to the Ingress thereof, not impeded by the variety of the Muscles; hence the Impulse is indeed less into the lateral Vessels, but more equal and forcible thro' the larger, therefore the lateral Pipes are fill'd by degrees, passing less thro' them, till at last they are almost at Rest; the little adipous Bags are fill'd with a gummy Oil, and distended as those of the Glands; hence the Circulation becoming sensibly slower thro' the sanguiferous Vessels, at last is scarce observable if too long protracted; while in the mean time, the accumulated Fat as a Balsam spread around, defends the inward Contents, and slowly by urgent Necessity affords a small Quantity of *Pabulum* or Sustenance. 2ly, From whence in moderate Sleep, how excellently are the Materials of *Chyle* chang'd into *Serum*, that in thinner Humours, and those again into Nutriments. 3ly, The Exercise of the Parts cohering in the Solids grow by degrees slower. 4ly, The Secretion upon the Skin increases, the rest becoming less. 5ly, The best Recovery of what is lost, for an equal, continual Repletion, restores the Fluids, and is the best way of repairing the Solids; because the impeding, troublesome and destructive Causes are at rest: While in the interim, the matter is happily made red, there is a Fitness in the Vessels, for Reception and Readiness to enter the Humours, and in the mean while, the Causes applying and consolidating Act freely. Hence therefore there is a new Production and Accumulation of Animal Spirits, as to matter throughout all the Humours, and as to Repletion in the smallest Vessels.

Being thus refresh'd and comforted by Sleep, there is an Aptitude or Inclination in the Body to waking again, and an Unaptness for Sleep; from whence being stirr'd up from an accidental Cause the Man wakes again.

Why,

Of Sleep.

Why, with a hot Head and cold Feet we wake and cannot sleep?

Why does Drunkenness proceed from Spirituous Things, and afterwards Sleep?

Whence come Dreams? And Whence Motion in those that dream?

In Sleep laudably taken not exceeding eight Hours, why is the Perspiration doubly greater, than it wou'd have been, in the same time waking?

How comes it that in sleeping too long, the Head is heavy, the Senses dull; the Memory weak; we perceive cold, Fatness, weight a Suffocation of Strength, the Muscles are unfit for Motion, and there is a Remission of Perspiration.

Whence does a continued Protraction of Sleep support Life a great while without Meat or Drink?

How comes it that from hearty or sound Sleep, Expansion of all the Muscles, repeated Yawnings, Sharpness of Judgment, Agility to the Muscles, and Strength to the Nerves, are always restored?

From what Effect do the *Fetus*'s in the Womb always sleep, Children frequently, and Youth more abundantly than Adults, or old Men?

And of what service is it, that such as are recovered lately from the most dangerous Diseases, sleep much longer than when they were perfectly well?

But the Reason, from whence the Muscles of the Heart suffer, not so much in time of Sleep, but on the contrary act otherwise stronger, seems to be understood if we have regard; 1st, to the Difference of the Brain's Softness, being made up of Cavities, girt in and compress'd with strong venous *Sinusses* that are expansive, and crown'd with great external arterial Circles; and to the difference of the solider more compact *Cerebellum*, destitute of any hollow, neither bound in or compress'd with any Venous *Sinus*, not expansive or compressible, but only supplied with Arteries and Veins. 2^{ly}, Cardiac Nerves

Of Respiration.

Nerves that owe their Origin only to the *Cerebellum*. 3ly, Coronary Arteries that are fill'd and emptied at contrary times, according to the rest of the whole Body. 4ly, The Cavities of the Heart are fill'd at the same time with the *Coronaries*. 5ly, The Auricles and Cavities of the Heart are fill'd and emptied in Motion, and at Rest alternately ; for from all these it is plain, the Reason of the Hearts Contraction is constantly renew'd, acts again, perisheth, or is at Quiet.

Of Respiration.

WHat Respiration is, and why it lasts without the Assistance of the Mind, will appear from what follows : For Order requires that we search it out ; and this Action not being frequently seen, is therefore hard to understand ; 1st, because it is partly vital, and partly voluntary, as also, because so many Organs are used for the Performance thereof ; wherefore it will be diligently enquired into, which may be most conveniently done by considering the *Phænomena* and Organs of Respiration.

The *Lungs* are suspended in Air, which hath free Access to them on every side, being equally press'd thereby, they fall together and contract themselves into lesser space, becoming much less than they were, while they hung intire in the *Thorax*, that Anatomy teaches : This Strength or Energy is discharg'd, first of all, by the contractile Action of the Muscular Fibres, and the squammous Segments of the *Bronchia*.

The *Lungs* thus contracted, if they are fill'd with Air, blown into them thro' the *Glottis* ; they distend from thence so far, that they take up the same Magnitude that they possess'd before in the *Thorax*, nay, they

Of Respiration.

they exceed that Number in space, as Experience informs us.

From whence it appears the *Lungs* always labour by their proper force, that they become less in all their Parts which happens so, while they are placed in the confined *Thorax*, hence they are always in a State of violent Contraction while the Man lives, and therefore close together and are lessen'd, while the intire *Animal* remains in *Boyle's Vacuum*.

On the other side, that it is not Air like that of the Ambient, betwixt the external Membrane of the *Lungs* and the *Pleura*, in all its Circuit in a healthful Man; therefore there is nothing that compresses externally the *Lungs*, but the *Diaphragm*; in the mean while, the Air always freely entring by the *Glottis*, is always there internally; from whence the *Lungs* is always little more extended by the internal Air, then it is compress'd by the external Air, hindered from the *Diaphragm*, being so knit to the Ribs and *Vertebrae*, that it cannot enter into the *Thorax* as is required, to make a balance.

Anatomy evidently demonstrates this Truth to be of great moment in these things; the Production and Increase of the *Fetus* in the Womb, and the Man out of the Womb, the Inflation of the *Lungs*; wounds penetrating the Cavity of the *Thorax*, procuring a Decay of the *Lungs*, and impeding the Dilatation thereof, sometimes inflicted on one, and then on both sides of the Breast; but especially the celebrated Experiment of *Hook's* perform'd on live Dogs.

Therefore since in a larger Inspiration the Air, which before enter'd plentifully by the *Glottis* into the *Lungs*, extended them the more, it will overcome the natural Strength of them, therefore the *Lungs* suffers in this Action; but what they do, the *Phaenomena* teach us.

In

In a *Vital Inspiration*, beheld first in a sleeping Man; the Nine Superior Ribs sticking in the Articulation to the *Vertebrae*, and in the Union with the Cartilages growing to the *Sternum*, arise with the arched Part so towards the Clavicles, that the Motion is chiefly observed here in the middle of the Arch; but the three or perhaps four Inferior Ribs are turn'd out, downward and backward a little oblique; but yet so, that the Seventh, Eighth, Ninth and Tenth Ribs, with their cartilaginous Segments are drawn together, as it were inwards. 2ly, It also swells the whole *Abdomen* more and more by degrees, even to the End of the Inspiration, and squeezes it very much outward. 3ly, But at the same time the Capacity of the *Thorax* is enlarged, as the putting a Girdle round the Waste, and the Eye it self discovers, and especially, the Mechanical Contemplation of the Figure, Situation, Connexion and Articulation, posited with the greatest Art, concerning which, consult the Demonstrations of *Borellus*.

But in that very Action the *Diaphragm*, from its convex and sinous Position which it had before, is brought into a Figure that is almost plain towards the lower Parts; for this, the Incision of live Brutes, the large Wounds of the Belly in them teach us; for that Change or Alteration of Figure depends on the Contraction of the musculous Structure in this *Septum*, as Anatomical Inquiry informs us.

Since therefore they are not otherwise in Inspiration, the Cause thereof will be determined by these things; to wit, the describ'd Motion of the Ribs and *Diaphragm*, wherefore we are to inquire into those Causes which produce such Motions.

The Ten upper bony Ribs saith *Vesalius*, are arch'd or curved, and in the middle much more depress'd, than in the extream rising Parts; being articulated in both their *Apophysis*, furnish'd with a Cartilage,
First,

First, In the cartilaginous Socket or Trench being imprinted with Bodies united laterally backward, or in the sole Body of the first *Vertebra*. 2ly, In the cartilaginous *Sinus* ingraved in the transverse Process of the *Vertebrae*; they are joyn'd together by an arch'd cartilaginous Segment very elastick, to an obtuse Angle upwards; that Segment from thence ascending enters into the lateral Cavities of the *Sternum* so, that as the Superior Rib, so the Angle of this Insertion is less at the meeting of the upper Part of the *Sternum*. The two lower Ribs, sometimes three being supply'd with one possick *Apophysis*, are articulated only to one *Sinus* in the very Body of its single *Vertebrae*, and with its Cartilages that are almost only tendinous, they reach not the *Sternum*, but being inserted to the *Diaphragm* and Cartilages of the next Ribs, disappear.

The Intercostal Muscles, that are external according to *Vesalius*, arising from the inferior Margin of the upper Rib, descend obliquely forward, and are inserted to the upper Margin of the Rib following beneath, with an intire osseous Circumference, but the internal Intercostals arising from the lower Margin of the Superior Rib, descending obliquely backward, cutting cross the former are inserted to the upper Margin of the Rib following beneath it, with an intire bony Circumference.

But the Subclavian Muscle, saith *Spigelius*, from the lower half Part of the Clavicle, where it is joyn'd to the Spine of the *Scapula* arising carneous, goes obliquely forward to the upper Margin of the first Rib, inserted near the *Sternum*.

Therefore if these Muscles are contracted or drawn together; then the first Rib by its proper Articulation is fastned sufficiently strong, by the force of the subclavian the nine following Ribs are rais'd upwards, and turn'd outwards, first in the middle Arches, yet so that they continue in an equal *Parallelism*, depressing

ing the cartilaginous Segments which are very much resisted, so that the Capacity or Breadth of the *Thorax* or Chest is sufficiently enlarg'd.

The *Diaphragm* as describ'd being contracted makes a plane or even Superficies; it strongly dilates the *Thorax*, constringes the *Abdomen*; conducts the anterior Cartilages of the Bastard Ribs inwards towards the *Vertebrae*, in some measure draws the two lower Bastard Ribs downwards, and distends the *Abdominal Muscles*.

And these seem to be the only Muscles, which perform Vital Inspiration; the *Intercostal* receiving Nerves, saith *Vieuassins*, from the *Dorsal Muscles*, and the *Diaphragm*, according to *Willis*, from those of the *Vertebrae*.

Therefore from the enlarg'd Capacity of the *Thorax*, betwixt the *Pleura* and the Superficies of the *Lungs*, nothing pressing them, it follows the Air entering therein, is breath'd by the *Glottis*, till they are the same again, or rather continue accurately contiguous to the *Pleura*, and for this reason produce all those Things which are said.

From these remaining thus, the Air moves or acts upon the *Lungs*, with the same or equal Force as the *Thorax* resists it, therefore the *Lungs* are at rest, hence less Blood will pass thro', it will be moved in less Quantity into the left *Ventricle* of the Heart, and so less into the *Cerebellum* and its Nerves: Then least Arterial Blood will be thrown into the *Intercostal Muscles* and *Diaphragm*, therefore the dilating Causes debilitate or weaken the *Thorax*, hence the Spring of the cartilaginous Segments depresses the Ribs again, from the assisting muscular Fibres, as *Bidloo* saith, arising from the side of the *Sternum*, within the *Thorax*, and from the osseous End, and also inserted into the Cartilage of the true Ribs; then the distracted Fibres, or those that are separated and drawn asunder of the *Peritonaeum* and *Abdominal Muscles*

cles returning to themselves again, hence the *Viscera* compressing, thrusts the lax *Diaphragm* upwards into the *Thorax*; the Breast is then constring'd, the Air expell'd from the *Lungs*: Expiration is made, and all Things done, as were said; but in the first Place, the Passage of the Blood thro' the *Lungs* is accelerated and performed by these two Actions.

Hence, in this very moment the Blood being quicken'd again, begins to flow stronger and more plentifully to the *Cerebellum* and the Muscles; therefore the contracting Causes recruit the *Intercostals* and *Diaphragm*, Inspiration is renewed; and so there is assign'd a true, present and sufficient Reason, for this alternate vital Motion.

But besides these Causes of vital Inspiration, there are others happen which serve the Will, and also cleave to, or are apply'd to the Ribs, for the violent Dilatation of the Breast, and its strong Constriction. The former tho' they serve for other Functions, yet they operate here, while they are thus determined or appointed for this Office. For the first *Scalenus*, saith *Vesalius*, rising fleshy from the forepart of the transverse Process of the second, third and fourth *Vertebrae* of the Neck descending obliquely forward, is inserted in the Tendon of the first Rib. Hence the second *Scalenus* arising carneous from the lateral part of the transverse Process of the second, third, and fourth *Vertebrae* of the Neck descending, it grows tendinous, and running over the first, it is inserted to the second or third Rib. Afterwards the third *Scalenus*, which arising carneous from the lateral forepart of the transverse Process of the second, third, fourth, fifth and sixth *Vertebrae* of the Neck, is frequently inserted to the first Rib; for by these the three upper Ribs may be rais'd, sustain'd and confirm'd, lest the Force of the *Intercostals*, and other Muscles, should be directed downwards in a strong Inspiration; neither is the bending or turning

ning round of the Neck hindred by the Force thereof; because if they act together, and if the Neck with its erecting Muscles, according to *Cowper* upon *Bidloo*, the spinal, the transversal, interspinal, the *longissimus dorsi*, *semi-spinatus*, by sticking close be strength'ned, the Action of the *Scalenus* necessarily raises the Ribs; but in the most violent Respiration, there are many more concur than we are sure of: In the fourth place the *Serratus anticus minor* of *Vesalius*, arising carneous, from the *Coracoide* Process of the *Scapula*, descending obliquely forward, being made larger, slenderer and fleshy, is inserted into the anterior ossaceous Part of the second, third, fourth and fifth Rib. 5ly, The *Serratus anticus major*, arising large, thick and fleshy, from the *Basis* of the *Scapula*, descending obliquely forward, is inserted in the eight upper Ribs, as it were in the carneous Parts; two or three whereof, are inserted below among them, with the like Processes of the external oblique abdominal Muscle. For if the Muscles of the *Scapula*, the *Trapezius*, *Rhomboides*, and the *Levator*, make the *Scapula* to and again immoveable, then the Action of both or either of the *Serratus* raises the Ribs strongly from the second to the eighth; which we may plainly see in the most forcible Inspiration. 6ly, From the back part of the upper *Serratus posticus*, arising tendinous from the Spines of both the inferior *Vertebrae* of the *Cervix*, and the three superior ones of the *Thorax*, is inserted with carneous Teeth to the Curvature of the second, third and fourth Ribs, raising these obliquely upward. 7ly, The inferior *Serratus posticus* assists, which arising from the Spines of the *Vertebrae* of the *Loins*, and sometimes from those of the *Thorax*, is inserted with clinging Fibres to the middle Arch almost of the ninth, tenth, eleventh, and the Extremity of the twelfth Rib; for here, from a kind of horizontal Course of Fibres, conducting or grinding these

these last Ribs outwards and backwards, it enlarges the Breast, and hinders, lest from the contracted Fibres of the *Diaphragm* being drawn together, these Ribs shou'd constrict the *Thorax*.

But the Action of the oblique exterior Muscle, that of the inferior and *rectus* conspiring together, depressing the Ribs, binding the *Thorax*, giving Resistance to the inferior *Serratus anticus*, if it concurs or agrees with the Action of the *Sacrolumbalis* of *Vesalius*, as yet a compounded Muscle that is scarce distinctly describ'd; it consists of a *Series* of Muscular Carneous Fibres, arising from the transverse Processes of the *Vertebrae* of the *Loins*, and the Spines thereof, and of those ascending into the Ribs and joyn'd there says *Steno*, by carneous accessory Muscles proceeding from the Ribs: This Action I say, powerfully assists a violent Respiration, together with the Constriction of the *Abdomen*, by the Help of the transverse Muscle.

The *Sternum* being compress'd in Women, and the right Clavicles, the *Thorax* grows narrower, the cartilaginous Segments of that *Clavicle* grow sooner into Bone on the upper Part, than the lower; hence the *Sternum* in those Inspirations is turn'd upwards and obliquely outward, and the whole *Thorax* does as it were rise, hence also they respire freer, when their Bellies swell, or they are with Child.

It is necessary that the Muscles serving for Respiration, and such as are obedient to the Will, shou'd be much larger and stronger than those which perform Vital Respiration: Whence it is, that the Strength of the former, serves to encrease or diminish, or intirely to put a stop to either Respiration of the efficient Actions.

Hence is to be understood, that there are not two natural moments that happen in the Life of Man, in which the Pulmonary Vessels possess the same Figure, Size or Action.

So that there is an *Antagonism* in this Place to some Muscles, without an Antagonist Muscle: Therefore the *Antagonism* is betwixt the Action of the Fluid moving the Muscles, and betwixt the Resistance of the simple Spring in the Solid.

From hence, there is no need for alternate Motions, acting reciprocally in both Parts, to suppose alternate Actions of the Humours, for 'tis sufficient if it happen in either.

Human Will can stop the Force and Cause of Respiration, but it cannot directly stop the strength of the Heart, therefore the Consent of the Hearts Motion is stronger, more constant, and its Action frequenter; yet there is some Cause betwixt the Pulse of the Heart, and Times of breathing, but by what Law we know not?

Hence we see a Necessity of the Hearts Pulsation from the Repetition of Respiration; but how long Life can continue without that, is the Question?

Why in an *Asthmatick* Insult, a *Peripneumonia*, difficult Breathing, in the Agony of Death, Respiration is made in the vital and voluntary Muscles, strongly concurring to the same Action, so that we see the Neck, *Scapula*, Breast, the lower Ribs and Back plainly move?

Why in perfect Health, when the Body is waking and at Rest, is Respiration so slow, quiet and silent, that it is scarce observed, while at the same time there is a quick Circulation of the Humours?

Why in a Cough, short Breathing and an accelerated Respiration, is the Motion of the Blood increas'd thro' all the Vessels?

How comes the first Action of Respiration to be *Inspiration*, but the last *Expiration*?

Why in dying Persons, while Respiration ceases, do the Venous *Sinusses*, the *Auricles* and the Heart palpitate?

And

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And how it is that in performing Respiration and continuing of Life, the Air is plainly useless in the excessive degree, whether heavy, light, moist, dry, hot, or cold; as also that which is too much compress'd or rarefied, as well as that which is not soon enough renew'd in a small Space.

Of the Voice, Speech, Singing, Laughing, Coughing, &c.

THAT this may be clearly conceiv'd, how a Man utters his Voice; this Sound is form'd from Expiration; therefore it is from the Expulsion or driving out of the Air, contain'd in the whole Capacity of the *Lungs*, into the *Aspera Arteria*, by constringing the *Thorax*, from the *Aspera Arteria* into the *Glottis*, saith *Casseri*, where from the Narrowness of the Passage the Motion is swifter, being broke or divided by the elastick tremulous Body, hence smitten into reciprocal Streams, it makes a Sound, as the *Naturalists* teach.

But that going out from the straiter Passage of the *Glottis*, into the Cavities of the membranous Body of the Mouth and Nostrils passing by these Places, as these Furrows, Trenches or hollow Places are smoother, rougher, opener or straiter, or otherwise figurated various ways, so different kinds of Sounds issue from the Mouth; as the Workmen who deal in Instruments of Sound, especially those who make Organ Pipes demonstrate.

But since the cartilaginous Sides forming the chink or cleft by its binding, can open or shut this chink by innumerable ways, as the Muscles placed here, act variously; hence arises the Difference of the Voice, as to what is call'd by the Musician, acute or grave; for all that Business depends on a swift

or slow Repercussion of the Undulation ; but this is done quicker, by narrowing the way, or increasing the Celerity of expelling the Air, on the other hand, the Gravity of the Voice is a slower Effect of the undulating Air, being deduced from a greater Aperture of the Chink, or a slower breathing out of the Air.

Hence it appears, from the Chink being too much dilated, that the Sound is destroy'd or lost in them, who endeavour to produce a graver Sound than indeed they can effect ; also the same thing happens in the Formation of the acutest Sound, that it almost brings a Suffocation, and causes a squeaking Voice to proceed from the *Larynx*.

If that Sound in the Organs situated without the *Larynx*, to wit, the Throat, the Tongue, the Teeth, the Lips, Cheeks, Nostrils, membranous or muscular Palate, in the various Meeting and Position of each being very much varied, is broken or divided, thence in its Passage thro', or Reflexion, be alter'd and determined or directed, it makes that which is express'd by Letters, concerning the Rise and Combination of which, and from thence, the Formation of *Speech*, let us look into the Works of *John Conrade Amman*, printed at *Amsterdam* 1692, who hath been a Man of vast Industry this way, and very eminent for his Success in the Cure of dumb Persons ; neither ought we in this Place, to forget the Labours of Mr. *Ford* late of *Kensington*, who hath brought this Art to so great a Perfection and Certainty, that he makes the *Deaf* as well as the *Dumb* to speak intelligibly.

But since to sing is to pronounce the Sounds according to Gravity or Acuteness, swifter or slower, stronger or softer, equally or by being fetch'd about, the Action of it is understood from which is said before.

A smooth, lubricated Superficies in the Organs, seems to give a Sweetness to the Voice, so likewise the

the Conformation of the Throat, the Mouth, the Palate, and Nose.

The Agility of the Muscles serving to move the *Glottis*, the Laxity that follows the Cartilages of the Ligaments, knit to the *Larynx*, the Size of Difference, that the Structure of the *Glottis* admits in its Aperture, seem to produce a ready Faculty for the distinct and clear Formation of various Sounds.

The Construction of the *Lungs* and *Thorax*, producing such Extension, seems to be the particular Reason of their Strength and Usefulness to the Body ; so the singular Turnings in sweet Singers depends on all these together.

Laughter is made, from the Dilatation of the *Lungs*, the Air being then received with quick yet small and reciprocal Concussions, made by the inspiring and expiring Organs, as if moved by little Waves moving in the *Lungs*, and in the *Aspera Arteria* ; in the mean time, the *Lungs* continuing in the same Extension, they rather shake than transmit the Blood thro' them ; whence we may know, the Reason why Laughing wearies so much, and often turns to a Convulsion ; first of all, only swelling or distending the jugular Veins, and those of the whole Head ; afterwards giving Redness to the Face, the Neck and Eyes : Sometimes if too extravagant, it brings on an Inability to take Breath, sometimes Apoplexy and Death it self : But on the contrary it is very healthful, if moderately used.

Also Coughing is evident from thence, for it is made from too great a Plenty of Air drawn into the *Lungs*, held there but a little, soon after by the *Larynx* being shut or clos'd together with the *Diaphragm*, thrust into the Breast by force of the *Abdominal* Muscles, the Air is condensed ; that strongly presses against the sides of the *Lungs*, from thence the *Larynx* being open again, it is violently shock'd, by the reciprocal expiring Concussions ; hence it

purges the Superficies of the *Bronchia*, whence is understood why *Laughing* so often ends in *Coughing*? How small the Difference is betwixt these two Actions? Why strong Singing, Scolding, the Asperity or Roughness of the *Bronchia* produce it?

So also *sneezing* already spoken of, is clearly understood from what hath been said: *Gaping* or *Yawning* comes from expanding or stretching almost all the voluntary Muscles together, especially the *Lungs*, which breaths in some small matter of Air, tho' slowly and by degrees, and that being retain'd there some short time is rarefied, and expired again, as it was received, restoring the Muscles to their former State and Condition. Hence the Effects thereof is to move, accelerate, and equally distribute all the Humours of the Body thro' all its Vessels; and therefore adapt the Organs of the Senses, and the Muscles of the Body, to their proper Functions.

But how these Things are done, the erect Figure of the Body, its Bending and Extension in the Neck, Back and Loins; the various Motions of the Shoulder, Arm, Wrist, Hand, Fingers, Thigh, Leg, Ankle, Foot and Toes, on which depend, Standing, Walking, Leaping, Running, Tumbling, &c. explain by their proper Organs of Motion, concerning which, we may look into *Fabricius ab Aquapendent*, and *Borellus* of the Motion of Animals; for this cannot be set forth in this *Compendium*, much less sufficiently demonstrated as is requisite.

Therefore since we have thus far explain'd the Vital, Natural, and Animal Actions which are common both to Men and Women, it remains that we consider, those which regard or are proper to either Sex, for the Generation of their Off-spring, as they are absolutely different from each other, as well as they differ by reason of Age, Temperament or the like

The Origine of the Masculine Semen.

THE Seminal Arteries arising from the Fore-part of the *Aorta* under the Renal Arteries, saith *Vesalius*, altho' sometimes it is call'd from the left emulgent Artery, descending obliquely with the spermatick Veins of its own side, the right whereof arises from the *Cava* under the Renal, the left from the Renal Vein, they are joyn'd together at an acute Angle included with these, with a common membranous little Sheath, being as it were closely conjoyn'd, so also they run securely together, cover'd under the interior *Lamella* of the *Peritonæum*, upon the *Psoas* Muscles, and the *Ureters*, till they come at the Place of their *Exit*, in the Groin, where *Spigelius*'s carneous Fibres of the transverse Muscle and the oblique inferior one, receding a little mutually from one another, transmit these Vessels included in its Sheath, so that the transmitting Place being highest in the transverse Muscle, the other is lower in the oblique ascending one, and then also passes thro' the oval Ring, in the tendinous Part of the oblique ascending Muscle, with three lines inferior to the former; lastly, this *Vagina* descends with its Vessels upon the *Os Pubis*, and being brought into the *Scrotum*, makes the *Testes* it self; but in all this course, from hence it binds out small lateral Arteries: And then the three Places transmitting in the Muscles, bestow upon that a little, thin, membranous *Vagina*, but where it approaches nearer to the *Testes*, they constitute the *Pyramidal Body*.

In this very course saith *De Graef*, the spermatick Artery being bent a little into Spires, sends forth Arterial Branches, which in a right, open and sufficiently large Road, derive laterally the Arterial Blood into an associate Vein, by a true *Anastomosis* or Inosculation; first of all, in the *Pyramidal Body*,

where the seminal Artery near to the *Testes*, bestows a Branch on the inferior, and inward Part of the *Epididymis*, affording little Branches to that, from whence 'tis inserted to the nervous Coat, and another Branch on the very top of the *Testes*; but there are many Branches from the large Trunk intimately mixed and communicating with the little Veins in the pyramidal Body, from whence they are spread all over the Circumference of the *Testes*.

For the pyramidal Body, call'd varicose, or *pampiniforme*, consists of innumerable communicating Veins, which being united, make up as it were a Netlike Texture, ending in one seminal Vein, from whence there is conveniency of pouring in this Blood into the little Veins.

Those Arteries which have penetrated the nervous Coat, being ordinarily divided into Branches according to *de Graef*, distinctly placed; then into innumerable small ones, as *Ruysh* shows, hence going into the finest Capillaries which appear infinite to the Senses, they possess almost the whole Body of the *Testes*, and perhaps usually posited into larger Vessels, says *de Graef*, ending in one great Trunk, the middle of the *Testes* continued to the *Epididymis*, they spue out their Humour or Fluid from a vast Number of little Mouths; hence they have no Veins, but end in Emunctories.

But those Vessels, saith *Leal Lealis*, are determined in the *Epididyma* and the *Parastata*, casting out their Humour into its hollow Canal; but its Fabrick or Structure is one continued, hollow, cylindrick Vessel, complicated into innumerable Windings united together, and incumbent on the Body of the *Testes*, being watered by the Arteries, is brought into one Vessel ending in the ejaculatory one; which rising again above the *Os Pubis*, descending into the *Pelvis*, approaching near to the back
part

part of the Neck of the Bladder, is determinated in seminal Vessels.

To the same Structure thus form'd, are join'd the slender Nerves, from the nervous abdominal Network, together with the spermatick Vessels, bestow'd on the nervous Coat, being lost in that and another that arises from the Twenty first spinal Pair.

The little small Veins and innumerable lymphatick Vessels, return that Humour again from the Body of the *Testes*, which remains from the Secretion made, which is probable in these in which it is elaborated, neither is there an Evacuation of the greatest and subtilest part of the *Semen* to be re-absorb'd in these Vessels, to be mix'd in the pyramidal Body with the venous Blood, and by this means change the whole Oeconomy of the Body.

The seminal Vessels of *de Graef*, knit to the Neck of the Bladder on the back part by Membranes, are little blind Intestines, saith *Leal Lealis*, complicated into Windings, Turnings and Recesses, in which the ejaculatory *Vas* ends, by degrees growing broader and more sinuous, then again straiter where it enters in, curved by a ready Road into these little Intestines, towards the larger bottom of those; and hence again, according to the same Author, from another emunctory Canal join'd to the former at acute Angles, which is endowed with a Vesicle, which two Emiffaries, join'd in the *Urethra* by an obtuse Angle, end in one Emunctory Canal, lying open in the *Urethra*; in the mean time, both these Vesicles are tyed together with a musculous Membrane.

All these things demonstrate the Blood to be like that of the Kidneys, small in Quantity, received from the spermatick Artery, moved slowly, and detain'd about the pyramidal Body, destitute of the thick red Blood by the Canals opening into the
Veins;

Veins ; hence it is less red there, being much slower moved, and almost stagnating, in the narrow Passages and Windings of the *Testes*, which are, as it were of a cineritious or ash Colour, the Blood being nourish'd and kept warm, adhering and growing thicker in *Higmore's* Ducts ; is more slowly puls'd into the *Epididymis*, is again blemish'd and elaborated from the Foldings thereof ; and at length found in the ejaculatory Vessel, opening wider by degrees, from whence in its dilated sinuous Recesses it is collected, kept at rest, nourish'd and elaborated ; and also from the broader, convoluted, seminal Cells of the Vesicles it is propell'd, received, and stor'd up, being intirely quiet and growing thicker, it attains a greater Whiteness, and so being elaborated to its utmost Perfection is call'd *Semen*.

Hence no Humour is produced with so much Slowness, or retain'd by so many Ways or Passages, or being at rest is cherished and encourag'd ; but whether in all that obstructed Course, any thing accrues to it, by the minute nervous Vessels or other ways, is a Question ? But there is brought to it thro' the Variety of Lymphaticks, something of a subtil Fluid, thrown into the little Vessels of the pyramidal Body, or the small Veins of the seminal Vesicles, from whence again it is carry'd into the Humours of the whole Body ; both of which is highly probable.

The Humour which is found in the very middle of the *Testes* in the *Epididymis*, in the ejaculatory Vessel and seminal Vesicles, being fresh, warm and a little diluted, then look'd upon with the best Microscopes, consists of innumerable, fine oblong, little, live Eels, swimming in the other part of this Humour ; but this is in every Man, Quadruped, Bird, Fish, amphibious Creature and Insect, and that always, and only in this place, according to *Leenwenhoeck* : If these things are compar'd with the
Size,

Size, Figure, Place and Change of the Chicken in the Shell, describ'd by *Malpighius*; and with the observ'd Law of Nature, in the Generation of Frogs; it will appear probable, that these *Animalcula* of the *Masculine Semen*, contain the first Rudiments of the future human Body; especially since where the *Testes* or this Humour is wanting, there is always Barrenness on the Part of the Male.

In the same place, saith *de Graef*, where the Exit of the seminal Vesicles opens into the *Urethra*, the *Glandula prostatica* of the *Urethra* arises about it, being one continued, conick Body, bound about with muscular Fibres, composed of Twelve distinct Collections of Glands, so that the Glands of every Aggregate, terminating by their Emunctories in one Bag, to which they pour in their Humour, hence the Twelve distinct Bags open with as many distinct notable Emunctories into the Cavity of the *Urethra*, so that they bind on every side that Exit of the Vesicles; from whence they nicely mix the *Semen* and the Humour of the *Prostata*, while the Vesicles and the *Prostata* are encompass'd by the same muscular Membrane.

The Humour made here, is soft, fat or oily, white and copious; after continued Abstinence from the Act of *Venerie*, it is frequently express'd in the Action of Siege or Urine. This Humour contains not the describ'd *Animalcula* in it, upon taking away the *Testes* and seminal Vesicles, neither is it then prolific: Hence the thicker and more cineritious *Semen* seems to dilute, and perhaps in the first moments from the *Coition* to nourish the said *Animalcula*.

The *Urethra* consists of Two Membranes, and a cavernous Body plac'd betwixt these, the cavernous Body thereof being thickest betwixt the end of the *Prostata* and the Union of the cavernous Bodies; from thence growing slenderer in its whole Course, it is grosser at the forepart of the *Penis*, turning out,
it

it leaves the Mouth of the *Uretbra* open in the middle of the *Glans*, but by that means constitutes the external spongy Superficies of the *Glans*; terminated in the outward Skirt or Edge thereof, about the Connexion of the *Prepuce* or Fore-skin, it receives into the Cavity of its Pipe oblique Emunctories, according to *Drake*, from the Glands assign'd by *Cowper*, making a soft Humour especially upon a flaccid *Penis*, that is bestowed for necessary Uses on the internal Superficies of the *Uretbra*: In the external Superficies of the *Glans*, *Ruyfch* saith, it is covered with a little, subtil Membrane, under which lie hid the sensible nervous *Papilla*, which are the particular and immediate Causes of Pain and Pleasure.

The cavernous Bodies, arising from the inferior Part of the *Ossa Pubis* separately, are cloth'd with its Membrane, and join'd mutually to each other by the Help of the *Septum Medium*, being lost by degrees at the anterior Parts, they make that particular Body of the *Penis*, which being made less sensibly at the Foreparts under the Crown of the *Glans*, constitutes the interior Substance thereof; hence all this Body thus compos'd or form'd, is surrounded with a cellulous Membrane of a wonderful Texture; from hence with a firm or strong nervous Case or Covering confining its Extension; and lastly with the *Cutis* and *Cuticula*.

The Arteries, saith *Graef*, from the internal Iliacks, frequently carry the Blood into the very hollow cavernous Bodies of the *Uretbra* and the *Penis*, where being divided into innumerable capillary Arteries, they are continued into Veins, but in these there are innumerable hollow Cells, according to *Ruyfch*, that communicate amongst each other, and all evacuate themselves into *de Graef's* great Vein, running singly thro' the back part of the *Penis*, under the Ligament joining the *Ossa Pubis*, about the *Prostata*, lastly dividing into Two Branches, they eva-

evacuate themselves both ways into the internal Iliack Veins ; but the Veins of the cavernous Body of the *Urethra* are placed for a necessary End or Design to those Muscles call'd the *Acceleratores*.

If therefore from what Cause soever, the Animal Spirits flow more from the Brain into the Nerves of those Muscles that erect the *Penis*, than those Muscles, says *de Graef*, arising from the external Bunch or Knob of the *Os Ischium*, under the Origin of the cavernous Bodies, are inserted in the firm, nervous Covering of those Bodies, and there growing tendinous are lost, the Body of the *Penis* is press'd closer to the *Os Pubis*, and the middle Ligament thereof : The great Vein of the *Penis* is more compress'd, the Veins of the *Prepuce* less ; therefore the Arteries and the Veins are both fill'd, hence the Vein is more compress'd, from whence the *cellulous Sinus's* are fill'd with Blood ; being therefore thus inflated, the *Penis*, the cavernous Body and the *Glans* all swell ; so that by this means the tumefying Causes increase, from whence the *Penis* grows stiff, reddens, and is erected ; in the *interim*, the muscular Membrane of the *Prostata* and the seminal Vesicles, from the same Cause ought to swell, and all the Nerves be stretch'd, hence the *Semen* from the Vesicles, the Humour from the *Prostata* being express'd, are gather'd together in that part of the *Urethra* which is free from the erecting Muscles ; while the transverse which are imprinted from the external bunching of the *Ischium* into the upper Part of the Bulb of the *Urethra*, and the *Dilatator posticus* from the forepart and the lower of the *Intestinum rectum*, being fix'd into the lower and hind parts of the *Urethra*, dilate it here at the same time ; lastly being violently compuls'd by the *Accelerators* of *de Graef*, which arising carneous from the upper Part of the *Urethra* under the *Os Pubis*, surrounding the Bulb of the *Urethra*, join'd below, they run together, and are both inserted to the
strong

strong Membrane of the cavernous Bodies of the *Penis*, and likewise being convuls'd with the Muscles of the *Prostata* and the *Vesicles*, the Blood is chiefly driven into the *Penis*, and the *Semen* ejected with Force, the Spirits cease their Motion, the Vein is freed, the Blood flows from the *Sinus's* into the Veins that are now relaxed, the extended Parts contract themselves again, and the *Penis* flags or falls.

Hence therefore it may be known, what the Man contributes to Generation, the wonderful Rise of the Beard and Puberty, also the Alteration of the Voice, Temperament of the Body, the Affections of the Mind, that either accompany or follow the Production of the *Semen*. Hence we may know, that the *Semen* is different or opposite to the Nature of the Animal Spirits, that of an oily, volatile, salt, or an hot fermenting Humour, but is a soft, viscous, sluggish, or unactive Fluid; and it shows that the transversal Muscles of the *Penis*, are of eminent Service for dilating the inferior Part of the *Urethra*.

Of the Menstrua.

Women have the *Os sacrum* broader, and turning more outwards than that of Men, as also the *Os Coccyx* yields or gives more way backwards; likewise the *ossa innominata* are broader, and stand more at a distance from each other, and underneath they are turn'd a great deal more outward; together with the inferior Risings or Eminences of the *Os Pubis*, which have the same bearing: Hence, saith *Spigelius*, a Woman hath the greatest Breadth about these Bones, the contrary of which is in Man, as also a greater Capacity of the *Pelvis* than what is to be met with in Men, yet in a Woman that is not with Child, there are not many things which
fill

fill her. Women have the forepart or appearance of the Breast much flatter or plainer than Men ; but the Blood Vessels, the Lymphaticks, the adipous and nervous Ducts, the Membranes and Fibres are much laxer in Women : Whence all their Cavities, Cells, Vessels, &c. are easilier fill'd in them, and the Humours collected together ; and hence the cellulous and adipous Membrane is always the thickest ; but it is found again to perspire much less than that in Men us'd to do, and therefore they much sooner arrive at the *aemen* or height of their Growth.

In this *Pelvis*, the Situation is soft and pulpy, consisting wholly of Vessels, easily extensile, neither is the Womb very elastick, but almost free, neither is it fixed or scarcely compress'd, while it is defended from the expanded Membrane of the *Peritonæum*.

But that consists of Membranes and Fibres of a turbinated or top-like Figure ; according to *Ruyseb* and *de Graef*, it receives Arteries from the *Spermaticks* and *Hypogastricks*, united amongst themselves by *Anastomoses*, surrounding the whole Womb, and as it were, constituting the greatest Part of the uterine Body, from the like *Apparatus* and Origin, all the Veins equally communicate amongst themselves, so that the Humour can pass and re-pass from one thro' all the rest ; it is penced thro' in its internal Cavity, not only with the Emissaries of the *Fallopian* Tubes, but with many small Passages, exsuding a soft, wat'ry, mucous Humour, with which the Cavity of it is internally lubricated, defended and hindred from Concretion.

As soon as a healthful Virgin hath arrived to the Term of her Growth, she begins to make more quantity of good Humours than is required to support the Body, since there is nothing further necessary to its Increase, she will fill more the Vessels, especially those of the Womb and Breasts, tho' they
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are very gently compress'd ; this will dilate more than the rest, hence it extends the lateral Vessels that are very full, evacuating an Humour into the Cavity of the Womb ; from whence, Pain, Heat and a Weight are perceived in the Loins ; at the *Pubes* and the Groin ; a small Fever is rais'd ; the Vessels of the Womb are dilated, so that they express the Blood it self into the Cavity of the *Uterus* ; the Mouth whereof is lubricated, relaxed, and the Blood issues out ; so that its quantity is lessen'd, those Vessels are not press'd so much, but contract themselves, the Blood is retain'd ; the grosser Part of the *Serum* is let out ; at last, that accusom'd *Lympha* only, makes more of the Humours again, which is easily deposited into the Vessels that have been once dilated ; hence the *Menstrua* are evacuated, and return at different times according to different Constitutions.

But since the Mammary and Epigastrick Arteries, have a wonderful Intercourse with each other, by the Communication of their *Anastomoses*, according to *Nuck*, it is evident, the same thing is in the Veins ; for upon uterine Evacuations the mammary Veins are less distended, and when the *Menstrua* are approaching, the Breasts swell, and so on the contrary.

Hence is understood, why Women who are of a harder Compages or Texture of Fibres, or dryer, likewise such as are very musculous and less fat, and also daily used to hard Labour, do less, and that slower and by longer Intervals, and sometimes ex-cern no menstrual Blood at all ? While at the same time, the softer, laxer, and such as are more juicy, and in some measure fat or plump, that are not so musculous, and live a lazy or idle Life, void greater quantities of Blood, that swifter and in a less period of time ? And also, why this Humour retain-ed here, makes to it self such various ways, with
other

other Vessels that are dilated, and expels them periodically? and why lastly the *Menstrua* shou'd begin, increase, and end in such a certain time of Age, in which they soonest arose? and why they cease again immaturesly in the same?

Of Conception.

Conception, saith *de Graef*, depends on two superior *Foramina* of the Womb, issuing from two membranous Canals, dilated by degrees round the *Matrix*, from a narrow Capacity, winding or turning in little cellulous half Circles, at last from a broad Orifice furnish'd with carneous Edges, plac'd about it; they consist of an interior glandulous Membrane with fleshy Ligaments; but these *Tubes* in almost all kinds of Animals at the Time of Conception swell and grow rigid or stiff, being supply'd with Caruncles: In the Dissection of the Dead Bodies of Women, the *Tube* is often seen surrounded with a rim or border of little Eggs; also in the cellulous Recesses of those, *Fætus's* have been found, in different Places and of different Sizes, according to the time of Conception.

The two *Ovaries* are laterally knit to the *Uterus*, saith the same Author, about two Thumbs breadth distance, and which by the Assistance of other Membranes arising from the *Peritonæum*, are strongly inclos'd; these are rough, of an uneven Superficies, sufficiently large, spherical Bodies, included in a strong Membrane, they are water'd by the *spermatick* and *hypogastrick* Arteries, united so before their Entrance into this Place, as if one Vessel being thus form'd, they seem to constitute a *reticular* or network *Plexus*, by reason of the incredible Number of Corpuscles, the same is true of the Veins seated here, and also of the numerous lymphatick Vessels;

all these Vessels with the Nerves as they make the Structure of the *Ovary*, so they are intermixed that the Fabrick can scarcely be describ'd; but in the Superficies of the *Ovaries* bound under the Membrane, are found little spherical Bodies underneath, concreted by a thickish Shell, from the very Substance of the Ovary, of a pellucid Colour, replete or fill'd with a Lymphatick Humour, that thickens at the Fire, consisting of two little concentrick Membranes, strictly tyed by turns to each other. Besides *Ovaries* are present in every sound female Body, tho' in Youth before the Years of Puberty, they are small, by degrees they grow larger, but are biggest at the Time of *Conception*, but they are observed to lessen or diminish again in Old Age. But the little Bubbles already describ'd, lodging in their Shells or Cups at the minutest Ends or Terminations of their Vessels, just after *Venery* scarce appear at all, but by degrees tumefy, by little and little become pellucid, grow thicker in their Membranes, raising and extending or stretching the Membrane of the *Ovary*, so they dilate into the Form of a *Papilla* or Nipple, that they seem to hang like Fruit each upon its Stalk, from whence being separated, they have a Cicatrice or hollow Scar, in the Substance and broken Membrane of the *Ovary*, healing or co-alescing again by degrees; at length in these little Bubbles, lodging in this part of the Ovary, the *Fœtus's* have been discover'd.

From all which it appears sufficiently plain, that these little Balls or Bubbles are Eggs, which derive their Structure from the Vessels of the Ovary, but its Liquor from the Humours wonderfully prepared there: And therefore this admirable Fabrick destined or appointed for this Office, is intirely from Nature.

From whence is known, that the *Tubes* being stimulated by *Venery*, grow stiff, from the rigid muscular

cular *Fimbria* or Edges like Fingers embracing the Ovaries; these being press'd close, expand or open their Mouths from this Embrace, then the Egg being ripe and separated, by degrees is squeez'd into its Cavity, and propell'd by the leisure Motion of their muscular Ligaments, at length is sent down into the Cavity of the *Uterus* for the same reason, and is there cherish'd and encourag'd if it meets the *masculine Semen*, or else expell'd if it was received into the Womb without it.

For if we may animadvert upon those things which manifestly happen in all *oviparous Creatures*; as also upon those which are demonstrated by our very Eyes to be in *viviparous*, at different times from the *Coitus*; lastly in those which are observ'd to happen in human Women, as well in a natural as preternatural State, in those with Child, and those brought to Bed being freed from the Part expuls'd; then it will appear that this *Modus* is neither impossible nor foreign to Nature, but on the contrary, must be held universal; as false Conceptions, Abortion, and the *Fœtus* found in the Cavity of the *Abdomen* confirm.

Therefore the *Masculine Semen* abounding with living *Animalcula*, stirr'd up and moved by the greatest Force, the utmost Heat, and perhaps the vast Plenty or Abundance of Animal Spirits, sent by a violent *Impetus* into the Woman's *Uterus*, then equally turgid, hot and moving, and at the same time equally water'd with a Flux of its own *Lympha* and *Spirits*; by and by being retain'd, heated and agitated from the convulsive Constriction of the Womb, running from the Egg, by a small lively Part enters incredibly thro' the then dilated Pores of the glandulous Membrane of the Egg, it is there retain'd, supported, kept warm and nourish'd, it suffocates the *Animalcula* that are not so lively as it self; and so Conception is made.

Which may be done therefore in every place, where such *Semen* can moisten or water the Egg; hence being pour'd thereon by *Fallopian's Tube*, applied to the Ovary, or meeting therewith in some Recess of that *Tube*, or otherwise in the very Cavity of the Womb, where-ever it can effect the same; yet it is not perhaps improbable, that the Conception is made perfectly from these brought to, and join'd with the *Uterus* at the same time.

The impregnated Egg is contain'd in the Womb, being shut up by the Stricture of its Muscles; it swims in a vast Plenty of abounding Humours, which being still made more liquid by Heat and Motion, they enter first of all from Impulsion by the spongy Passages adhering to one part of the Egg, distending, filling and increasing its Bulk, where again being render'd subtiler from the same Causes, they nourish the *Embryo*, surround, embrace and defend it against an unequal Pressure; and also they make the Membranes of the Egg in like manner thicker, and at the same time stretch or extend it, first in that part in which it stuck to the *Ovary*, so that they may there form the Rudiments or Beginning of the *Placenta*, which seems to be that very Receptacle of the Egg, first of all forming the Substance, which increases in Dimension almost every moment of time.

But while the very same Causes are still constantly more and more renew'd, they proceed to increase the Size of the *Egg* and the *Embryo*, and likewise the *Meatus* as well of the *Placenta*, as of the little Membranes are enlarged; the *Egg* begins to fill the Capacity of the *Uterus* with its own Bulk, to apply and joyn its Convexity to the hollow Superficies thereof, and every where to be united to the small slender Vessels, sent out and received in there, but particularly in the Place of the *Placenta*; by which means the Womb is extended every way round, and by

by an equal Proportion all its Vessels are enlarg'd in equal measure, receive more Humours into them, and consume the Materials of the *menstrual Plethora* hence in like manner from the same Proportion, by which the Passages of the Egg increase, likewise the Emunctories of the *Uterus* are dilated, so that the Capacity of those united to these, in course joyn the Vessels of the *Ovum* and the *Uterus* together ; for the same reason the Efflux of *Lympha* or Blood is hindred from out the Womb, and it occasions the uterine Vessels to be emptied into the distended Egg and its Ducts, and by an interchangeable Course those of the Egg into the *Uterus*.

And because the *Fœtus* is now join'd by the *Navel-string* to the very *Placenta*, and determines the Humour here, from both the conveying Vessels out of the *Fœtus* into the *Placenta*, but from greater Vessels bearing out of the *Placenta* into the *Uterus*, it is evident that all the Humours collected here, must be perpetually thus renovated by these ways, so that it cannot stagnate or putrefy.

But where this mutual Enlargement of the Inosculation swells or grows bigger, that the internal uterine Emissaries may send forth their Blood, and otherwise receive it again, then the abounding Blood contain'd in the large *Arterial Uterine Vessels*, brought to the *Uterine Placenta*, may be driven from the dilated Vessels thereof into its Structure, and so seems to be sent to the *Fœtus* ; because an *Hæmorrhage* happens in Abortion, Delivery, wounds in Gravitation, Child-bearing, &c. from the Separation of the *Placenta* ; as also the spewing out of Blood in the *Fœtus* upon the Mother's being only wounded seems to prove that ; altho' they may seem to hinder the Vessels from appearing in the *Cadaver*, and the intire little Membrane, binding the Superficies contiguous to the Womb.

For the whole Body of the *Placenta*, saith *Ruyfch*, is made up of innumerable Arteries, dispers'd round every where, as in the *Cortex* of the Brain, interwoven by the like Artifice with Veins, Lymphatick Bags and Vessels; then it is surrounded with a little thin Membrane, very apt to tear; it receives, according to *Spigelius*, Two Arteries running retrograde, and proceeding to the Navel of the *Fætus*, there sent in to the subcartilaginous Substance of the *Navel-string*, being there supported and defended, bringing back Blood from the *Fætus* that is not so proper for Circulation; but the Origine of the Veins is so fine, that they scarce appear at all, yet being collected together into one Trunk, is inserted into the *Navel-string*; this Vein entring in by the *Navel*, tending upwards, enters thro' the Fissure of the middle of the forepart of the Liver, at the inferior part into the great Sinus of the *Vena Porta*, agreeable to *Glisson*, and pours in all the Blood it carries, yet so that from the Entrance of this umbilical Vein, it is placed in the Sinus of the *Vena Porta*, from thence, according to the same Author, another Pipe going out from that Region into the *Cava*, where it is tyed to the *Diaphragm*, from whence it may easily furnish Blood to the *Liver* or the *Cava*, and from thence to the Heart; from thence being distributed according to the Laws of Circulation, thro' all the Circumference of the Body.

Furthermore, the Blood pour'd in from the whole Body of the *Fætus* and the umbilical Vein, into the venous Sinus of *Lower*, entring almost at the Auricle, descends at one side into the Heart as in *Adults*, but at the other, it is thrown against the middle Partition betwixt the Two Auricles; in which Partition is placed an open *Foramen* or Hole, to which lies the membranous Part, so that its moveable Part has Communication with the Cavity of the left
Auri-

Auricle, from whence it appears to act upon, or move the Portion of Blood from the right Auricle into the left, as long as the Lungs are not moved; or at least, in the next adjacent Parts in the Auricles, from the venous *Sinus* of the *Cava*, into the venous *Sinus* of the *pulmonary Vein*.

That Portion which enters the right Auricle of the Heart, is all moved by its Force into the Trunk of the *pulmonary Artery*, which from the Obstruction and difficult Passage thro' the Lungs, suffers a great Resistance; hence it forcibly dilates the free Trunk of the Artery; then passes in a small quantity thro' the Lungs, and going slowly thro' the Arterial Vessels is hindred from Concretion, growing bigger, and stretching out according to the Increase of the *Fœtus*; from thence it returns from the Lungs into the *Pulmonary Vein*, is mix'd to the whole Mass by the Admission of the *Foramen ovale*, neither is it a little obstructed in its Passage by this gentle Motion of the Blood; from whence both is driven into the left Auricle, from thence into the right; but the greatest Part of the Blood of the right side of the Heart finds in the arterious side of the *pulmonick Canal*, an open channel, saith *Bartholin*, every where equally broad from the *pulmonary Artery*, entring a little obliquely into the *Aorta*; by which therefore, all that Blood passes from the *pulmonary Artery* into the *Aorta*, being puls'd from the right Ventricle, which can easier master the Resistance of the Blood in the *Aorta*, than the obstructed Lungs can procure it; but the left Ventricle of the Heart driving the Blood forward, mixes with that Blood that will be shortly describ'd; therefore the Blood of the *Fœtus* wants all the Effects or Operation of the Lungs upon the Blood, yet it acts upon it however; and so the subtil Part or Portion of the Blood of the *Fœtus*, separated in the Vessels of the Mother's *Uterus*, and elaborated in the

Placenta, is constantly mix'd with the Blood of the *Fetus*, afterwards flowing thro' the minuteſt Veſſels of the Body; but the thicker Part given to the umbilical Arteries, by a mechanical Neceſſity from the Oppoſition of its Courſe, is ſubdued again from the Reſpiration of the Mother; while in the mean time, the Obſtacles have regard to the Life of the *Fetus* in the Paſſage thro' the *Placenta*.

Nevertheless, there is a nutritious Lymphatick prepared in other uterine Veſſels, which is made ſo fine and ſubtil, that it can be moved out of the *Meatus's* or narrow Ducts of the *Uterus* into the Pores of the *Chorion*, and being more nicely changed in the Veſſels thereof, paſſes into the little Canals of the *Amnios*, where being further wrought or elaborated, drops into the Cavity of the *Amnios*, and being there drawn in at the Mouth of the *Fetus*, is ſwallowed, lodges in the Stomach, and is digeſted, being acted upon by the *Bile*, the *Pancreatick Juice*, *Saliva*, and *Inteſtinal Humour*; it paſſes into the *Chyle*, drawn in by the chylous Ducts, and into a ſoft or pulpy *Fæces*, being driven by the Motion of the Guts, even to the *Sphincter* of the *Inteſtinum rectum*, after Collection in the *Colon* and *Cæcum*, but not evacuated, becauſe the Strength of the *Sphincter* cannot maſter them, while there is no Action of Reſpiration; whence it is, that in a perfect *Fetus* this whole Tract of the *Inteſtines* is often full.

But ſince the *Saliva* and *Mucus* in Deglutition, the *Bile* and other Humours by overflowing, are received in the Guts, and all ſuch like, continually depoſe ſome *Fæces*, theſe being added to the former matter, concur to the making thereof.

Nay the *Kidneys*, ſays *Euſtachius*, at this time large, and being aggregated from leſſer Bodies, water the urinary Bladder by a continual dropping, filling
of

of it gently by degrees, with a small Quantity at a time, of a soft, unacid Urine; but the Emission of this is stop't from passing thro' the *Uretbra*, it being not able to overcome the Obstacle of the *Sphincter*, except by the force of Inspiration; but where it abounds, it enters into a membranous Canal according to *Spigelius*, always going out from the bottom of the Bladder ascending upwards, issuing from the *Navel*, stretch'd out with the *Navel String*, even to the Root of the *Placenta* where it ends, agreeable to *Hale* in the Philosophical Transactions in a particular Bladder, proper and distinct from the *Amnios* and the *Chorion*, consisting of a Membrane finer than the other two, of an Oval Figure situated betwixt the *Placenta*, cover'd over with the *Amnios* and the *Chorion*, and betwixt the *Chorion* turn'd back upon that, and united thereto; for this Store house of Water, the Humour whereof grows more in Quantity, of a higher Colour, and approaches nearer to Urine, as the *Fætus* encreases in Size, and is nearer to the Birth.

Therefore where the Intestinal *Fæces* and Urine encrease, and have not Power to be expell'd, the Quantity, Weight and Acrimony becomes troublesome to the *Fætus*, who now turns his Head downwards into the Place, where the internal Mouth of the *Uterus* is placed, his Face being in the mean time towards the *Os Cœcyx* of the Mother; the *Intestines* and *urinary Bladder* being fill'd, begin to stimulate the Fibres, to excite in them the Sense of Pain, and to produce Motion and Contraction in the abdominal Muscles and to the whole *Fætus*, from whence the first Disturbance is increas'd, hence it begins assiduously to struggle with all its Endeavours by turning it self every way, to descend towards the lower Parts, and to create a *Tenesmus* to the Mother; hence the abdominal Muscles begin to be violently drawn together, and the *Fætus* to be driven
down-

downward into the *Pelvis*, and so the proper *Tenesmus* to be increas'd, from whence by the utmost Endeavours of the Mother and the Child, the internal Orifice of the Womb is dilated, at that time anointed and made lax, from the most lubricating Mucilage, the Water of the *Allantoides* and the *Amnios* is driven forward, the little Membranes are broken, and the Waters flow out, the Head is mov'd or push'd on to the Capacity of the dilated Orifice, and then by the Addition of the Mothers throws, it is excluded thro' the lubricated Places, being follow'd by the *Navel String*, the Membranes and *Placenta*, call'd the *Secundine* or *After-birth*, and oftentimes Blood issues out with it.

These being discharg'd, the Fibres of the Womb, the *Peritonæum*, the Muscles of the *Abdomen* and the other Vessels, which were so much distended during the last Period of Gravitation, begin to contract themselves and their Vessels, especially the *Uterus* which as *Ruy/ch* saith, gently and by degrees contracts it self, expelling the Blood collected here, being first, pure, and in Quantity, then diluted and less, at length growing viscid, pale, and very little, by the Name of *Lochia*; which are different as to Plenty, the time of Evacuation, Colour, Smell and Consistency, as there is a different Temperament or Constitution of the Woman in Childbed, her giving of Milk, &c.

After these Parts are contracted, the Vessels being more constring'd, give a greater Resistance to the Blood sent hither, so that the third Day after Delivery, the *Hypogastricks* that communicate with the Breasts, begin to infuse or pour in more Blood to these dilated Parts, that were us'd to be brought to the Womb, and therefore aqueous chylous matter therewith; from whence the Vessels of the Breasts are fill'd and more distended from the same matter; hence from the Alteration of the Motion of the Humours

'mours arises a little *Fever*, a swelling, Pain, Hardness and Milk in the Breasts.

For the Breasts, saith *Nuck*, being fabricated in a Place at Liberty only with Fat about it, and under a Skin that is easily stretch'd or very dilatable, they receive external Arteries from the *Axillaries*, internal ones from the *Subclavians*, sent down into the *Thorax* or Chest, by the *Intercostals* and the *Sternum*, going out of those Parts, joyning to the Breasts, and communicating to the *Epigastricks*, from whence they pass into wonderful spiral Contortions and little Knots, and then emit small milky Pipes which uniting together grow bigger, and last they form the great broad lactiferous Vessels, ending in one strait one, by a little narrow Channel issue out in the *Papilla* or Nipple, yet so, that from the Arteries by the milky Vessels into the *Nipple*, from that by the Milky Vessels into the Arteries, there is a free, Egress and Regress; but these nervous, spongy *Papillæ*, have many Emunctories, varying in Number, and communicating by *Anastomoses* or Inosculation before their *Exit*; from whence Suction being apply'd, the Milk comes forth, and is continually renew'd or made again, and that more in Plenty according as the Breasts are suck'd the more.

That Milk easily passes into Whey, Cheese, Cream, and Butter, the caseous Part of which wonderfully hardens; that it does not grow hard at the Fire like the *Serum* of the Blood, but exhales off from the remaining Dregs, and often sours of its own accord; is sweet, white, and almost without Taste, is from the Chyle, and the oily, soft, maternal Humours mixed in the Circulation.

And hence it is plain, why Pain in the Breasts, Hardness, Tension, Elevation of the Nipple, and a dripping of *Serum* at Evening happen, during the Time of Gravitation? And why these are increas'd at first, Three Days after Delivery?

Then

Then whence it comes, that upon a Repulse of the Milk, the *Lonchia* are greater, and so on the contrary?

Likewise why Colour, Smell, Taste and the Strength of what is taken in at the Mouth, is so remarkable in the very Substance of the *Milk*?

Why does the *Milk* scarce flow at all naturally, but upon the first sucking leaps out with force?

Why there is *Milk* in the Breasts of Infants of both Sexes, in Boys as well as Girls?

And why of all the Animal Humours *Milk* only naturally sours after that manner? And why it so easily deposites a Cream and Cheese?

The *Fetus* in the very Labour, endeavouring by continued Struggle, and being expos'd to the Air, dilates its Breast, admits in the Air, expands the *Lungs* to their utmost Dimension, enlarges the Vessels thereof, lessens the Resistance of them against the Blood of the Pulmonary Artery, from whence it rushes violently into the Vessels set at Liberty, flows into the Arterial Canal, and being plentiful and swift, it runs into the Pulmonary Vein, presses the Valve of the *Foramen Ovale*, shuts the *Foramen* it self, enters with all its Quantity into the left Ventricle of the Heart, and is expell'd again, it presses the Side of the *Aorta* more, folds together, contracts and shuts the Arterial Canal; hence the Blood of the right *Auricle* and the venous *Sinus* is driven into the right Ventricle, from thence it is mov'd into the *Lungs*, and Respiration is made as in Adults or grown Persons, the Membrane of the *Foramen Ovale* grows thick at the Edges thereof, the Arterial Canal is chang'd into a Ligament.

But from the binding of the *Navel String*, near the Skin, nothing flows by the Vein thereof, into the Liver; the Vein changes into a Ligament; then the swifter Motion of the Blood of the *Vena Cava* compresses the oblique venous Canal, that it
may

may harden into a Ligament, and also the umbilical Arteries are consolidated.

Respiration being now perfected, the *Fœces* being black, tough, shining like *Opium*, call'd *Mecanium* is purg'd out, so likewise the urinary Bladder by the same Labour, and from tying the *Urachus* is evacuated by the *Urethra*, as in Adults.

From all which things, all these Problems are resolv'd, as first, what does the Father or Mother contribute to the begetting of their Off-spring?

What is the Cause of Barrenness in either Sex, in the Male or Female?

Whether from the Masculine *Semen* alone, a real Man can be produced, by any Art?

Whether any Woman, from any natural Cause, without the Conversation of Man, can be fruitful?

Whether the Menstrual Blood be malignant and venomous, or endued with any Poison? Or whether it is to be esteem'd impure and a Recrement?

Whether a Woman makes any true genital *Semen*, like that of the Nature of Man's, that can conduce to the Production of her own like?

Whether from the Mixture of the *Semen* of either, Ebullition, Fermentation, or any other Action makes the Body of Man?

Whether *bona fide*, a certain Place proper for Conception, can be assign'd?

Whether the Woman, besides Warmth and Nourishment, gives any Form to the *Fœtus*? Whether the Force of Imagination of the breeding Woman teaches us that?

What is Fecundity?

From whence the Membranes of the *Fœtus* take their Origin, as to matter, and as to the Cause?

From whence the *Placenta*? the *Navel String*? And how are the *Embryo* and *Fœtus* ryed to that?

Whether

Whether is the *Fetus* nourish'd by the Mouth, or the *Navel*, or by both? And with what Difference, according to the Difference of Time from the Birth?

Whether the *Fetus* hath all its *Viscera*, Vessels, and Members together? Or that it changes its Form or Figure from the first *Animalcula*, then to an amphibious Creature, and lastly, to an Animal having the Breath of Life in it: Or whether it breaths in the Womb, and makes use of Air?

Whether it exonerates in the *Uterus*? And why not? Whether the *Meconium*, found in the *Vagina* or Neck of the Womb, or fallen from thence be an Evidence of the Death of the *Fetus*, or otherwise what is?

Whether there can be a *Superfetation*, or one Conception form'd upon another? And why is it so rare, if ever?

Why have *Twins* if there be three or four of them but one *Placenta*, as it appears they are tyed to, and yet every one possess proper or distinct *Navel Strings*, and Membranes? Whether because the little Eggs are each united only to one Cup or Stalk? Or whether that is always and in every Place found true?

From whence comes the nauseating in a Woman with Child, Pukings, Vomitings, Faintings, Horrors, debauch'd Appetite, Hardness of the Breasts, Pain, Swelling, Wasting, Retention of the *Menstrua*, Short Breath, Cough, *Varices*, or an Enlargement of the Veins of the Feet, Legs, Thighs and Belly?

ΠΑΘΟΛΟΓΙΑ or Pathology.

The Nature of a Disease.

Hitherto hath been declared and explain'd, from the Indication of their Causes, the Actions and Principles that are exercis'd in the human Body, by the Motion of the Humours in their proper Vessels, and the Resistance the Vessels give to those Humours, being call'd by a known Term *Functions*; and these us'd to be distinguish'd into Vital, Natural and Animal; the Vital Functions are those which make Life, so that it cannot want them; these are the musculous Actions of the Heart; the secretory Action of the *Cerebellum*, the Action of the Lungs and Blood, and the Circulation of the Spirits thro' those Organs, the Arteries, Veins and Nerves; from whence 'tis plain, that these in their Perfection may encrease or lessen much, and yet Life remain still: The Natural Functions are those which change or alter the Things so, which are received into the Body, that they pass into our own Nature, or become Part of our selves, which are the Actions of the *Viscera*, Vessels and Humours, receiving, retaining, moving, changing, mixing, discerning, applying, excerning or carrying out, and consuming what is brought unto them, which also may be convey'd in divers Parts: The Animal Functions are those which happen so in Man, that either human Intellect conceives *Ideas* of the same Nature from thence, which are united to the Corporeal Action, or the Will is moved from these excited Actions; such are the Taste, the Touch, the Smell, the Sight, and the Hearing, Perception, Imagination, Memory, Judgment, Reasoning, the Affections of the Mind, voluntary Motions; in all which

which is also a great variety of Degrees. From hence may be physically understood, what Life properly is, how long it lasts, in what Things it accurately consists, what it may want, and yet be able notwithstanding to continue; hence also Health is understood to be a Faculty of the Body, apt or perfectly fit for the Exercise or Performance of all its Actions. Lastly, It appoints all the Effects of those Actions, to determinate Motions and the Unalterableness of the Things taking into the Body.

The State of the Living Body taking away, or disabling the Faculty from the Performance of any Action, is call'd a Disease; the *Idea* of which is the Possibility of the Absence of something requisite to the Exercise of the Action, or the Performance of something present, that is repugnant to the same: Neither is the mention made of the Mind in this Definition; because the State of the Mind individually attends or accompanies the determinate State of the Body; and because Medicine acting upon the Body only, Habit or Custom restores the Conditions of the Mind; as also because the alter'd Condition of the Mind, neither produces good nor harm, to the State of Health, except it arises from some corporeal Effect.

He therefore that wou'd perfectly understand all the intellectual Conditions requisite to Actions, he may plainly see the Defect of the Condition from the Knowledge of the Disease, and again we'll take the Nature of the Disease from thence, necessarily following from the Knowledge of the Defect: which is call'd *Pathology*, and is divided into its proper Parts.

The

The Differences of Diseases.

Therefore as well as Actions, so Diseases may be distinguish'd, as the Conditions to Actions, and also the Defects of them: Hence 1st, Diseases of a simple, solid, or organick Part. Secondly, Diseases of the Humours, regarding their Nature, Quantity and Accidents. Thirdly, Diseases compos'd from both these, which are human, and that Male or Female which relates to Men and Women; to all which *Classes* we shall proceed in a *Compendium*.

Similar Diseases.

A Disease of the most simple solid Part, call'd *Similar*, properly in the first Place, obtains in the last or extremest Fibre; which since it is a Body merely terrestrial, fine, simple, nervous, or else arising from Nerves, made up of the most subtil earthy Parts, connected by a certain Strength, it is subject to Diseases of too much force, too great Weakness, Contraction, Relaxation, or Solution of Unity: The first Four have always a certain Reason from the *Symetry* of their Body; hence there is a salubrious Difference to one, and oftentimes a morbid one to another.

The same Disease together with its Differences obtains. 2ly, In the minutest Membrane made from Fibres of the like Nature, being joyn'd or interwoven together: And 3ly, In the smallest nervous Canals, constituted from a hollow cylindrick Concretion of such a Membrane. 4ly, In a Membrane made up of such little Canals, executing the Office of the Fibres. 5ly, In Canals form'd from such a compounded Membrane, which are all the larger

P

Vessels

Vessels of the Body, only differing in a different degree of Composition: 6ly, In those solid Parts which consist of Canals, destitute or void of any distending Humour, or which from a gross one, together with a proper coercing and concentered Vessel, changes as it were into a particular thick Part: For if the Diseases attending all these separately were examined, they wou'd be found to be such as will be hereafter describ'd.

Likewise in these Parts that were once healthful or sound, Diseases may arise of an ill Structure or Conformation, if the smallest Solids nourish amiss, or are ill apply'd, and indeed Particles added to the Substance, Figure or Solidity of a Body may grow wrong; but a sickly Contrariety seems again to have only these Diseases as are now describ'd.

Organick Diseases.

BUT where a certain Part of the Body compounded of innumerable Parts, performs an Action from the Motion of the Fluids, which should be done by the Function of its Instrument, or any other Office from the Strength of its Conformation, then it may be regarded in it self, as a solid Part, or as to the Humour contain'd therein: If the first is allow'd, then the Diseases call'd Organick, are most aptly examined under these four *Classes*.

First, The Violation or Injury of the Figure, either in the internal or external Superficies, as also in Accidents of either, as to Roughness, Smoothness, Straitness or Crookedness, Laxity, Density, Cavity, Solidity, which are call'd Diseases of an ill Conformation.

2ly, As to Numbers in Excess or Defect.

3ly, Increase or Diminution of Size.

4ly,

4ly, Situation, Connexion, and from hence, Excess or Deficiency of Motion.

But the Superficies it self being first sound, but afterwards hurt or broken, consists either in the different Union of the compounding Part, or in the Diseases of the Humours offending there.

Forasmuch as the Superficies forms Cavities, that make Passages, Sinusses, Receptacles, it may offend or transgress in Number, from whence sometimes Diseases are either from the extraordinary, large or small Size of the Cavity.

If the Natural Capacity of the Cavity encreases too much, or a new one be formed, there arises a threefold Mischiefe or Inconvenience, which is call'd *ἀνασφάλσις, διαπύθισις, διαίρεσις*, : In the first, the Mouths of the dilated Cavity, emit what is retain'd in them : In the next, the Parts constituting the Membranes are so divided, that the *Interstitia* gape so wide, as to let what shou'd be contain'd there quite through : In the last place, there happens a true Separation of the cohering Parts; from whence these Species of Diseases deserve to be remembred, frequently ending in one *Diarexis*, and sometimes restoring themselves; but these are best explain'd from Mechanicks.

The Strength or Force of the Fluid encreasing, the Vessel is too much enlarg'd as to its Capacity, and forms Diseases which are injurious and offend in fecerning, excerning and casting the matter through.

In lessening of the Cavity, there is suppos'd to be five several Species; first, the *ὑποεξίτις*, or Stoppage of the Cavity, by a viscid, thick, grumous, inflammatory, calculous, sandy, purulent, adipous matter, shutting inwardly the very Cavities of the Vessels. 2ly, *σπασμὸς*, or a Narrowness of the Passage, when a Tumour rising in the proper Substance of the Membrane, constituting the Cavity, binds up and stops the *Meatus*. 3ly, *θλίψις*, or a Compression of the moving

moving sides, when some external Cause squeezes the Membranes too and again to the Vessels, it lessens its Cavity by degrees, and at last perfectly takes it away. 4ly, *σύνεσις*, When the Sides of the Cavities forming either to the *Thlipsis* or the *Emphraxis*, so entirely coalesce, that the whole inward Capacity is lost. 5ly, *συστήσις*, From which they are call'd empty Vessels, having their sides falling together, from the large Distension of their Tone by some morbid matter; and to this we may refer the too great Contraction of the Vessels, by a force that exceeds the Strength of their Orbicular Fibres.

But an organick Part rarely errs as a Disease, in exceeding the Number; except from thence, a wounded Action follows; but often labours from a Defect that ought to be number'd or reckon'd as a Disease.

But a morbid Size in an Organick Part, is frequently reckon'd as such, which also is faulty as well in Excess as Defect. The first, comprehends Tumours, *ὥσπερ ὄγκους*, Nodes, Tophes, *Exostoses*; and this may be often assign'd to the Narrowness of the Cavity about the strait Ends, and the Dilatation in the middle, or to the *κακωχημίαν, ἐκσύμωσιν, διέσειν*; but the latter thereof is present; where the required Size of the Part is lessen'd in Action; and the Conception thereof is confirm'd in the *Atrophy*, and *Phthisis*, a Wasting, Consumption and Mutilation of the Part.

Lastly, a Disease of the Organical Part consists of an ill Composition with other Parts; which is lodg'd in the Situation and Connexion, in which the Motion or Want of Motion of the Part is contain'd: To this Disease therefore belongs the broken Figure of the Parts knit together, the too great shortning of the united Ligaments; the faulty Elongation of them, their Laxity or Rigidity; at last
a Dis-

The Diseases of the Fluids or Humors.

a Disruption, a Want of requisite matter amongst the Parts joyn'd together, or else a Depravation, or Fault in what is present: Distortion, Relaxation, Subluxation, which there happen upwards, downwards, forwards, backwards, inward, and outward, from thence deriving many Names to them, which are useful to the Understanding thereof, and their various Distinctions. *Umbilical Hernia's*, and such as are in the *Groin* and *Scrotum* in Men; *femoral Hernia's* in Women, as likewise those of the *Caul*, *Intestines*, *Air* and *Water*; the *Falling down* or the *Descent* of the *Womb* and *strait Gut*, the *starting out* of the *Muscles* and *Tendons* from their proper *Places*; the *Loosness* or *Rupture* of the *Membranes*, *Bands*, that retain the *Joynts* or *Bones* in their due *Situations*, are very pertinent Diseases in this Place, the Understanding of which are highly necessary in the general Design of Medicine.

And there is a Disease common to the solid Part, that is simple as well as organical: Which is simply call'd *Solution of Continuity*, if made in a simple Part; but if in an Organick a compounded one, it is variously denominated, from the Nature of the Part, the Diversity of the Cause, and Difference of the Application: To this relates *Wounds*, *Fissures*, *Punctures*, *Contusions*, *Ulcers*, *Corrosions*, *Dilacerations*, *Ruptures*, *Fractures*, *Exfoliations*, *Caries* of the *Bones*, a *Spina Ventosa*, &c.

The Diseases of the Fluids or Humors.

THAT the Diseases of the Fluids may be rightly understood from hence, and digested into an exact Order, we are to know the Functions requisite in them, or those Things which are universally necessary to every distinct Liquor; or else the particular ones adapted to the human Species, or lastly,

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those secret ones, which constitute the Nature or Disposition of each particular Man. The Universals are such as make up the Minuteness of Parts, which escape the naked Sense, so small an Endeavour on a mutual Contact, as scarcely can be exceeded in the minutest sensible force, that Lubricity of the *Superficies*, that scarce amount to a Change or Alteration amongst each other: But in Respect of human Nature there are many Things happen, that have different Functions, from whence arise many different Diseases.

All which Diseases may yet be easily reduced to a Vice in Quantity or Quality, if the Fluids are regarded in themselves.

But if they are consider'd as they are coerced in the definite Solids, then they are found to err first of all in Place or Proportion.

That Abundance or Quantity of good Humour which hurts the Functions, is call'd a *πληθὺς*, which is understood in a good Sense of the chylous matter, or that call'd *Hæmatopoiesis*, which flows together with the slender Expense of what is exhal'd, these are describ'd as to what is made by the Vessels or their Strength.

That Scarcity of good Humour, which injures the Functions is rarely to be met with, except some external Force suddenly produces it, when there is an ill Disposition or Temperament of the other Juices in the Fluids.

That Quality of the Humours which hurts the Functions, is call'd *κακότης* or a *Cachochymia*, a depraved Habit, which is resident in the Fluids, as they regard the compounding Parts, together with the Mass of Fluids, or considered with the whole Substance of the Fluid together, as a Part concurring to make up the human Body.

If the morbid Disposition be consider'd in every particular Particle of the Humour, that will be fix'd
either

either in the increas'd or lessen'd Substance, or in the greater or lesser Solidity of the Particle; or it will consist in the Figure, as well in its Rigidity, Flexibility or Elasticity, various Cohesion, or lastly, in its Divisibility.

The *Idea* of the increas'd Substance in the Parts of the Humours, shows by the Unpassableness of them an *ὑπερξίς*, in the lesser Vessels an *Atrophy*, &c.

The *Idea* of the Substance decreasing, in the Parts of the Humours shows the *διανόλις* and the *ναρκαγία* to be too great.

The Encrease of Solidity if conceived in the Parts of the Humour, there is to be understood too great Strength that changes the Solids as well as Fluids, and likewise that there is in the solid Parts an *ἀντιστοιχία*, a *διαπύκνσις* and a *διαρραγή*; but in the Fluids too much Attenuation and Attrition.

If the Solidity appears too much diminish'd, there is an Unactiveness to be conceived, as well in the Vessels as in the Fluids, hence comes Rest, and soon after Cohesion.

A Particle of Humour errs from its own Figure, when receding from a spherical Nature, it takes upon it an angular acute one; hence applying its whole Motion to a small Part, it becomes acrid; these Recesses are various, but commodiously restor'd or renew'd: First, To an Acrimony meerly call'd Mechanical, where all remaining the same, the Figure only is form'd into solid acute Angles. 2ly, To an Acrimony call'd Saline, which is first, *muratic*, *Ammoniac*, *Acid*, *Alcalisate*, *Fix'd*, *Volatile*, *Simple* and *Compound*. 3ly, To an oleous one, which is that of Oil attenuated into Spirits or Oil, as it were burnt, by too much Attrition, of a Saline Oil, an Earthy Oil, an Acrid one, as compos'd of the burnt, saline and terrestrial together. 4ly, To a saponaceous Acrimony, such as is to be found in the poisonous Parts of Animals and Vegetables. 5ly, To the

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the Acrimony compounded of the four preceding ones, as also that which arises from the eating of Acid Things, as from Vitriols and Metallick Bodies.

But that Disease is very grievous, and the Humour scarce curable, if the Particles thereof are so rigid, that they cannot be master'd or overcome by the Strength of the human Body, neither can they be divided or figurated into little proper Parts. But the same being too changeable in their Figures are morbid; for by the Evenness of their Superficies, they grow together by increasing their Contacts.

And a Disease is as observable in the too elastick Parts of our Fluids, because that constantly changes all the *Compages* of the Humours too much, upon the least Change of Heat or compressive Motion.

Nay too firm a Cohesion of Substance in every Particle is ill; for so it hinders the Production of the lesser small Substances out of the greater, which are yet so necessary to a perfect State of Life: On the contrary, too easie a Divisibility is hurtful; for that is repugnant to the Constancy of Health and Life.

And thus it is that Diseases are of the greatest moment in the Science of Physick, and the understanding the *Basis* thereof, the best *Pathology*: Yet they can scarce be understood, except from an accurate Observation of their Effects, which may be made in sick Bodies; from whence it is plain we can best see the morbid *Idiosyncrasy* of the Humours.

But if you will behold all the Humours together, you may find the Diseases of them to be particularly, either too great Fluidity, or too great Thickness, the first passing with too great Motion thro' the Vessels, or the latter too inclinable to Rest; or else lastly, some Disease composed of Vices already enumerated,

And

And there are notable Diseases that arise from the same continued Humours ; but are render'd morbid only from the Change of Place ; of which there are Two Classes : First, If the Diameters be too much increas'd in the Vessels, the grosser Humours are received in straiter Channels, which by degrees grow narrower. 2ly, If the Vessels by any means be broke, the Humours issue out, and are collected in the *Interstitia*, made from their Distension into the solid Parts of the Body ; from whence we may understand the Rise of *Inflamations*, true or bastard *Aneurisms*, and *Enchymoses*, &c. as also *Oedema's*, *Fistules*, *Dropsies of the Head*, *Breast*, *Belly*, *Womb*, *Ovaries*, *Testes*, *Scrotum*, *Peritonæum*, and thro' the Habit of the whole Body, from a peccant or vitious *Lympha* ; as likewise an *Emphysema* from the Air.

But these stagnant Humours, collected and affused, putrefying by Heat and Rest, grow purulent, ichorous, corroding and acrid ; they destroy the young tender yet solid *Stamina*, from whence they make *Sinus's*, *Fistula's*, *Ulcers*, *Gangreens*, *Cancers*, and the like.

But these are the primary Differences of Diseases, taken from the very Nature of them, which, tho' they are so fertile in producing the greatest Share of other Diseases, they scarce deserve to be number'd amongst the Causes of Diseases.

But it hath obtain'd its Use among Physicians, that besides they distinguish Diseases from some external Accidents, which tho' they are common to many very different ones, yet have their Distinctions, and a celebrated Use in Physick, tho' they are too much multiply'd with subtil Division ; therefore the following particularly have left out several.

First, by reason of the Cause they are *ἰσχυρά*, *συμπάδνα*, *πρωτοπάδνα*, *δευτεροπάδνα*, hereditary, conate and acquired,

Secondly, By reason of the Subject, they are Diseases of Age, as of Infants, Youth, Adults, old People, Diseases of the Sexes Male and Female, of Virgins, Women, with Child, Parents and Nurses; then such as are universal and particular.

Thirdly, By reason of Time, the acute Diseases are such as terminate within Four Days; the peracute within Seven; the acute within Twenty Days; all the rest are *chronick*; whereof some are vernal or autumnal, continual or without Intermision, moderate or temperate and intermittent.

Fourthly, By reason of their Effects; salubrious, benign, malign, curable, incurable, mortal and contagious.

Fifthly, By reason of the Condition or State of the Disease, its Beginning, Progress, Extremity, Decrease and End.

ΑΙΤΙΟΛΟΓΙΑ ΠΑΘΟΛΟΓΙΚΗ Σ;
Or, Pathological Aitiology.

THE Cause of a Disease is call'd that which makes the Disease Present, and is scarcely always real; or it really produces a new State in the Solids and Fluids, which is the Disease it self; or it takes away that which is altogether requisite for the Exercise of its Function.

If that pre-exists any-how in the Body before the Effect produced, it is called internal; but if existing without the Body, from thence apply'd to it, it produces a Disease call'd external.

The internal ones frequently hurt the Humours first of all, then the solid Parts; the external ones chiefly affect the Solids first, and after that the Fluids; except by chance some few poisonous and contagious Diseases.

The

The *proximate* or nearest Cause of a Disease is call'd all that together, which makes up the whole immediately present; this is always intire, perfect and sufficient for the Distemper, whether simple or compound: This being present, plants and continues the Disease, but absent, it is removed; but is almost the same *Ens* or Being existing in the whole, and is chiefly necessary in the most useful Enquiry.

The *remote* or distant Cause of a Disease, is call'd that which so changes the Body, that it makes it fit to receive the Disease, if any else be added to it; therefore it is not at any time perfect, or sufficient to produce any Disease of it self; neither can that Addition to it alone effect it, but both together; therefore Medicine directs, that both should be eradicated at the same time: Both these united make the *proximate Cause*.

The remote Cause inherent to the Body, is call'd *πρὸνυπόλη*, or a Disposition before-hand; as for example, a Temperament or Constitution of Body as to hot or cold, *Plethora* or *Cacochymia*; a vast Abundance, or Depravity of the Fluids.

The Cause which approaches, or is added to the *remote*, excites that so, that they make a Disease together, call'd the *Procatartick*, or *πρὸκαρτικὴ*, by some the *Occasion*; it is injurious by Pre-dispositions only as it makes such a Disease; sometimes it is internal, sometimes external.

These latter the most commodious of all and most apt to assist the Memory, may be reduced to Four Classes chiefly useful, which are,

First, The things received or convey'd into the Body; Air, Meat, Drink, Medicine, Poison, which are introduced by the Spiracles of the Skin and Nostriis; by the Passages of the *Mouth*, *Lungs*, *Gullet*, *Stomach*, *Intestines* or *Pudenda*; from a visible or invisible Species, from a Fume or Vapour, a Draught, Clyster, and what is *infus'd* into the Body.

Secondly, Gestures; the Motion of the whole Body; or a Part; and the Affections of the Mind; Rest of both kinds whether sleeping or waking.

Thirdly, The things retain'd; Excretions whether salubrious, or Recrements whether they be morbid.

Fourthly, External Applications to the Body; as Air, Vapours, Fomentations, Baths, Cloathing, Liniments, Ointments, Emplaisters, Wounds, Bruises, Causticks.

Which are otherwise divided into Six *Classes*, under the Title of the *Six Non-naturals*; Air, Meat and Drink, Motion and Rest, the Affections of the Mind, Retentions and Excretions, Sleep and Waking; enjoying this Name, because by the Use or Abuse of them, they may be made naturally good, or unnaturally bad: They may be reduced under these Heads, but it will be more convenient and proper to make use of the precedent Division.

The Air, when too hot, dissipates the Moisture of the Eyes, Nostriis, Mouth and *Aspera Arteria*; there it dries up the Vessels; it thickens the Blood in the Lungs; from either of which Causes it hinders their Actions, exciting many Diseases that arise from thence; it carries off the external Humours that are always thinner, and exhales the Residue within; it dissipates the more agile Parts, and collects together the slower, which it unites and dries; therefore it daily lessens the aqueous, spirituous, volatile, saline Parts, but on the contrary, increases the fix'd, saline, oily, gross, tenacious, acrid, earthy ones, which it accumulates and unites together into indissolveable Masses; hence comes the Impassableness of the Humours, together with the Weakness of the Solids, and what follows from thence, to wit, Obstructions, Dryness, Inflammations, Stoppage of Digestion, Putrefaction, Costiveness, Thirst, Strangury, red Urine, yellow Jaundice,
acute

acute, hot and dry Diseases ; and first of all, these Actions principally injure the *Lymphatics*, and the *Genus nervosum*.

A cold Air shortens, thickens and strengthens the solid Fibres, hence their Actions increase the Fluids ; but where they thaw again, it destroys and dissolves the Fibres ; the same cold or chilling Air binds and thickens the Humours, dries and straitens the Lungs, coagulates the pulmonary Blood, from whence come Obstructions, Inflammations, Difficulty of Breathing, Coughs, Catarrhs, Mucus, Pus, Gangreens ; but if the Body is mov'd strongly together, then the Action of the Solid, is so increas'd into Fluids, and that of Humours into Liquids, that it makes the greatest Attenuation, Perspiration, Voraciousness, Weakness, Fainting of the Spirits and sudden Death ; if on the contrary, Rest, and the utmost Coldness in the Air brings on Stupidity or Numbness, excessive Pains in the Limbs, and the Scurvy to the last degree.

If the same Air be too moist, it relaxes, dissolves and weakens the Fibres, and first the pulmonary ones ; retains the *Serum* in the Lungs, increases and gathers it together, hindring Perspiration therein ; from whence come Coughs, *Peripneumonia's*, *Diarrhoea's*, Sleepiness and Fevers ; if great Heat be join'd to it, sudden Putrefaction, if great Cold, a serous Flux of Rheum.

A dry Air produces almost the same Effects, with too great Heat, the Air being too heavy, compresses all the Canals and Fluids of the whole Body, but especially in the Lungs, from whence it gives too great Resistance to the Heart, suffocates the Motion of the Humours, and kills.

So, if it be too light, it dilates by a less Pressure the Vessels, and rarefies the Humours ; hence come Tumours and Eruptions of the Humours which create

are Diseases ; then the contractile Force prevails, the Dilatation is resisted and overcome in the Pulmonick Fibres ; whence Respiration is stopt, the Blood is there accumulated, there is an acute *Peripneumonia* and Death it self.

The Heaven, the Season of the Year, the Earth, Sea, Mountains, Lakes, Fens, Rivers, Vapours, Exhalations, Meteors, give such a Change to the Air, that it creates various Diseases, not depending so much on the Disposition of the Air, and of its Functions and Qualities, as on the Nature and Efficacy of the Mixture ; from whence therefore they ought to be inquired into and understood.

But Winds act upon our Bodies, either by their Motion, or as they convey to us some Qualities of the Air ; it is impossible to tell those things of 'em, that will quadrate with every Season and Climate, but the chorographical Knowledge of a Place, the Neighbourhood of adjacent Parts of which is seen by us, compar'd with the Seasons of the Year, may afford us something real and advantagious ; in like manner from a certain successive Series of what follows, we have often remarkable Effects ; for first they act as hot, cold, moist or dry ; hence they alter the Solids and Fluids.

Meat and Drink may offend in the Production of Diseases, either in Quantity or Quality ; if they act amiss in Quantity, they effect this in excess or defect.

If they offend in too great Plenty, the *Stomach* is too much extended, hence arises a *Convulsion* from closing the Orifice thereof, its Vessels are compress'd, Dilution, Digestion, Contrition, Separation and Expulsion are hindred ; from whence come *Dyspnœa's*, a perverse Circulation of Humours, Crudities, Ructations, Nauseating, Heartburn, Vomiting, Putrefaction, Vertigo, Confusion of the Senses, a Cachexy,

chexy, all which Vices being once rais'd, are happily corrected in the following Functions.

But if it be defective from an absolute Want, which is indeed a mere Defect, it produces nothing of it self, but then in the interim of time, they waste and destroy the solid Parts of the Body that maintain the Actions of Life, they dissipate the subtil fine Fluids, and inspissate or thicken the remainder; by a constant repeated Attrition they dissolve the Oils and Salts, extricating the volatile acrid Parts that corrode the minute and tender Vessels, putrefy the Humours, pollute the Breath, hence comes a saline Spume, which is acrid, bilious and putrid in the Stomach first, and then in the Intestines; Ructations or Belchings, Loathings, Faintness, an outrageous or devouring, and afterwards a Dejection or intire Loss thereof, unquenchable Thirst, Dryness, Weakness, Gripes, Plenty of Gall, Vomitings, Leanness, Watchings, Epilepsies, violent Fevers and Death.

From whence it is evident, that too much Abstinence creates worse Diseases than too much Repletion, and the Vices of the former are much more difficult to cure, than those of the latter, agreeable to *Hippocrates*.

But those Vices which lodge in the ill quality of Meat and Drink, may commodiously be apply'd to Acrimony, Viscidity or Oilinefs: The Acrimony of the Meat and Drink is first saline, but this is muriatic, naturally acid or fermenting; the first raises Thirst, Hoarseness, Roughness, Dryness, Rigidity, an Acrimony especially in the serous Humours, a like Dissolution of the Fluids, an Unaptness of the serous *Lympha* to Nutrition, a Destruction of the minutest Solids, corroding Pangs, and *Scurvy*. The other which is a simple *Acid*, or for the most part *sour*, astringes, incrasates, coagulates, first of all creating an acid Acrimony, excruciating Pains,

Pains, Heart-burn, Paleness and Scabs; which more particularly lodges in Summer Fruits that are not fully ripe. Lastly, the third is in acid Wines or Vinegars, which produces the like Mischiefs, but not so grievous; from hence by the too frequent Use of these things, an acrid acid *Serum* is produced, the consequence of which are *Rheumatisms* and *Gouts*.

In the second place, there is an acrimony in Meat and Drink which is aromack, as chiefly consisting of Salt and Oil united with Acrids; this makes Thirst, Dryness, Heat, Burning, stimulating the Solids, and giving a swift Motion to the Fluids; hence come Heart-burning, Heat of the Stomach, Loathing, Belching, Vomiting, Fevers, Wasting, Contractions, and other Diseases depending thereon.

The Third is an acrimony prepared from a spirituous Fermentation, increas'd by time, being raised by Distillation to the highest degree, as that in Wine, old Beer and distill'd Spirits; this produces Thirst, Drunkenness, a dry Constriction of the Fibres, a Coagulation of the Humours scarce resolvable, the quickest *Stimulum* and sudden Loss of the solid Parts; hence there is the greatest necessity of pouring on the like sort of Liquor, from whence arise Weakness, *Flatus* or Wind, Obstructions, Fevers, Tumours, Dropsies, a *Leucoplegmatia*, and the like Evils.

Lastly, in the fourth place is found, a penetrating fermenting Acrimony, which is in the Crude Must of Summer Fruits in Wine or Malt Drink, but in the very Act of Fermentation, by shutting the Vessel close is soon suppress'd; this creates Ructions, Wind, Spasms or Contractions of the Stomach and Guts, Vomitings, Cholicks, Diarrheas, Dysenteries, Iliack Passions and the like.

But too great Viscidity of Meat from unfermented Flower, or from the Gelly of Animals, as well as from tough Cheese and hard Curd, generates a
Weight

Philological Aitiology.

Weight in the Stomach, Wind, Crudities, Obstructions of the smaller Vessels in the Intestines, hence come an Unactiveness of the Guts to Motion, a Swelling and Hardness of the Belly being bound, as also from the same cause a viscous quality in the Blood from the united glewy Particles thereof, hence Obstructions at the Glands, Paleness, Sluggishness, Cold, Tumours.

But too much Oiliness, lubricates, relaxes and weakens the Solids; obstructs the Mouths of the little Vessels; hence it hinders the Passage of the aqueous Fluid; depraves the Mixture of the Humours, excites or raises the burning nitrous Acrids; from which proceed Ructations, Loathings, and bitter oily Vomitings; then it occasions exceeding Thirst, Obstructions, Inflammations, Indigestions of the *Viscera*, and many Mischiefs arising from thence.

Too much Motion throughout the Body, or in any particular Part, always increases Contractions, and reciprocal Relaxations of the *muscular Villa*, and likewise a Celerity in all the Humours; hence the Fluids and Solids by too much Attrition are dissolved; the aqueous, spirituous moveable Parts are scatter'd or dispers'd; the residuary Humours changed into an inflammatory Thickness; in the meanwhile, the Oils and Salts being too much attenuated, ground, made volatile and acrid, are as it were exalted into Corruption; the gross and tenacious Oils are accumulated; the Humours are as it were burnt or set on Fire, especially that of the Bile, the Marrow is consumed; the little Cells are fill'd with *Ichor*, a Leanness or Consumption is made; hence Weariness, Pain, Inflammation, Fever, Suppuration, Gangreen, a Hemorrhage and sudden Death. But if this happen in a *Cacochymick* Body, or one labouring under a Consumption of any of the *Viscera*, and especially if in the Height of Summer, it is quickly mortal.

Too much Waking consumes the Spirits, so that they are to be repair'd by no Art, but Sleep; it dries up the rest, grinds the Solids, especially those fine ones of the Brain, increases the Acrimony, hinders Concoction and Nutrition, exasperates the Bile; hence there is a Production of Fevers, Delirium, &c. Generation of Melancholy, Agitation, Evacuation, Sadness, a deprav'd Imagination and perpetual Inquietude.

Too much Rest of the Muscles throughout the whole Body, or in a single Part, renders the muscular Fibres unfit for Motion, lessens the Celerity in all the Fluids; hence comes Concretion Unactiveness as well of the Fluids, as of the Principles that constitute them; a Repletion of the Cells, a Collection of Marrow, Fatness, *Leucoplegmatia*, Coldness, Sleepiness, Slowness; from whence are known the Effects of Idleness, and a sedentary Life.

Too much Sleep consumes the volatile Parts, and by degrees thickens the Rest; it collects those things into the lateral Vessels, and scarce moves them; it retards the Excrements, it loads the Brain, fills the Head, and dulls or stupifies the Senses; hence it becomes hurtful to those who are inclinable to it, beyond others, and is advantageous to such as are addicted to Waking.

The Affections of the Mind that are violent or continue long, wonderfully and forcibly change and deprave the Brain, Nerves, Spirits and Muscles, from whence they are capable of producing almost all sorts of Diseases, and supporting or maintaining the Strength of them, according to their Diversity and Duration.

Too large an Excretion of *Saliva* disturbs the first Concoction, and after that the following; it procures Thirst, Dryness, Melancholy, Consumption and *Atrophia*; but if it is not excern'd into the Mouth, or much less than usual, then it hinders the
Man-

Manducation of the Victuals, Tasting, Swallowing, Digestion, and likewise increases Thirst.

Too large an Excretion of *Bile* or *Gall* by the superior or inferior Parts, destroys the making of *Chyle* in the first Instruments; hence it hinders the Concoction of Victuals, the Secretion and Excretion of *Fæces*; produces an acid Temperament, Cold, Weakness, a *Leucoplegmatia*, Fainting; but if it stops what is made from flowing into the Cavity of the Intestine, creates yellow *Jaundice*, together with the foregoing Vices.

The *Lympha* of the *Pancreas* and Intestines, if too much of it be driven into the Guts, produces the like Mischiefs as when the *Saliva* is faulty in like manner; as also *serous Diarrhæas* at first, from whence proceed the greatest Weaknesses, Faintings of the Spirits, Dryness, Thirst, Hætick Fevers, and a *Marasmus*. If it flows not into the Intestines, or that very slowly, then it makes thick and compact Substances in the Guts; hence come Weight, Repletion, Gripes, Twisting of the Guts, Thirst, Fever, hard Stools, Tumors, &c.

Too plentiful an Excretion of Blood; whether it be made by *Anastomosis* from the Liver, Intestines, Kidneys or Womb, or by a *Diuresis*, *Diaporesis* or Wounds; it takes away the Strength, sinks the Spirits, destroys all Actions, accumulates crude, wat'ry, cold Humours; produces a *Leucoplegmatia*, Dropsy, a Relaxation in all the Vessels, and an Enlargement of the Arteries: But the Blood by the Hemorrhoidal Vessels or the natural Courses of Women, or other accustom'd Places that formerly us'd to flow periodically or otherwise, being now intercepted, makes topical and dire Inflammations, Suffocations and Stoppage of Circulation, Fevers, wonderful and various kinds of Diseases; but especially very strange Hemorrhagies in other Places.

Too large an Excretion of the *Semen* produces Laffitude, Weakness, Inability to Motion, Convulsions, Leanness, Dryness, Pains in the Membranes of the Brain, Heat, especially of the Eyes, Dulness, Consumption in the Back, Foolishness, and several other Diseases bordering on these.

A Superfluity of *Urine* makes Dryness, stops the Passage of the Humours, produces Heat, unquenchable Thirst, Crudities, a Subduction or Lowness of Spirits, Leanness, *Atrophy*, and the like Mischiefs; and too much Sweat effects almost the same thing; but a Suppression of *Urine* weakens the Bladder, *Ureters* and *Pelvis* of the Kidneys, and intirely destroying their Texture by distending, corroding and putrefying the same, it forms an alcalisate Acrimony throughout the whole *Lympha* of the Blood; hence by injuring the tender *Stamina* of the Brain, it brings on Sorrow, Heaviness, troublesome Sleep, *Vertigo's*, *Apoplexies*, &c.

Too great abundance of *Sanctorius's* Perspiration makes the greatest Weaknesses, hence arises a *Deliquium* or Fainting, and at last sudden Death; but if this be very flow or suppress'd, it makes the Vessels of the outward Skin dry and wither, hence proceeds Obstructions of the larger Secretions; the Circulation is alter'd, the acrid Parts are there retain'd, from whence arise Putrefaction, Crudity, Fevers, Inflammations and Apostems.

Cold Externals being apply'd, shut the *Meatus's* or Passages, and contract the Fibres, driving back what was retain'd there and hinder their Exhalation, by which means they effect what the impeded Perspiration had occasion'd. Moist or humid things wash the Excrements, open the Mouths of the Vessels and relax them, inviting the Humours to the outward Parts, whence if they exceed they produce the same Diseases, as too much Sweat: Dry things act the contrary way; whence we may understand

derstand the Use of Baths, Fomentations, *Epidemics* and the like, if we first know the Manner, Quality, *Modus* and Time of Application.

There are several internal things so general to the Body, that many Diseases depend on them as their Causes; from whence they are proposed in the general Enumeration of Causes, and are wont to be explain'd by their Causes; and these are a *Plethora*, *Cacochymia* and internal heterogeneous Matters.

A *Plethora* is made, supported and increas'd in the Body, whose *Viscera* are capable of making plenty of *Chyle*, whose sanguiferous Vessels are lax, and who eat Victuals of good Nourishment, are of a middle Age, of a sanguine Constitution, whose Minds are unemploy'd, and who enjoy a competent share of Rest. This produces intolerable Heat and Motion, an Extension of the larger Vessels, and a Compression of the lesser; hence upon the least occasion given, there is a Laceration of the Vessels, a Suffocation of the Liquids, and a lazy or sloathful Unactivity.

A *Plethora* may be consider'd, either in those things which happen to the Humours extrinsically, or in those which adhere internally in them, and then again, either in all together, or in any particular.

Therefore where it happens, that there is first too great a Motion of the Humours thro' the Vessels, that make a Compression, Attrition, Attenuation, Heat and an inflammatory *Diatbesis* of the Humours; and consequently the same Diseases as have been already explain'd from too much muscular Motion: But the Motion being too slow, produces the direct contrary. First of all there is a dangerous Motion, either from the excess or want of the nervous Spirits, from whence all Concoctions,

Secretions and Excretions are hurt, and from thence are produced Diseases almost of all kinds.

But too great a Fluidity of the Humours, produces too much Exhalation or Expence, Consumption, a disturb'd Secretion, a Constriction of the larger Vessels, Emptiness and Weakness of the same; Obstructions, Ruptures, and Suppurations in the lesser; which are hurtful in the first place, if too great Acrimony and Motion attend together.

But too great Tenacity of the Humours brings forth Obstructions, Extension of the Vessels, Pains and Tumors, first at the Glands, and then at the Arterial Unions: But where an Acrimony is likewise join'd to that Tenacity, then according to the different proportion, with which these Two meet together, there is chiefly made a Destruction of the Vessels, from whence the Humour being pour'd out, there follows Pustules, Inflammations, Gangreens, Cancers, Itching, Ulcers, a Caries and the like.

Crude, acid Humours, sour, vinous, fermenting Acids, chylous and milky ones, together with volatile and fix'd Alcalies, also muriatic, armoniac Salts, the saline, oleous aromack Acrids, produces the like Diseases as proceed from the Vice of the Aliment, which always contain some of these Principles therein.

A yellow *Bile*, like the Yolk of an Egg, being often rais'd by its own Motion, from a Convulsion, a Disturbance of the Mind, or from some other Cause scarce yet discover'd or explain'd, produces many and those grievous Diseases, as Loathing or Abhorrence of Food, Grief, Hiccups, Heart-burns, Iliack Pains, Colicks, Gripes, Wind, Irruptions, or Belchings, Diarrhæas, Dysenteries, acute Diseases, Fevers and Convulsions.

But black or melancholy *Bile* call'd so from its Colour, and nam'd *Bile* from its Situation where it is collected, and from whence it is discern'd; being
some-

sometimes of the Taste of the sharpest Vinegar, but sometimes like that of putrefied Blood, it corrodes, burns and scours, exciting Inflammations, *Gangreens*, *Sphacelus's*, the most afflicting and bitter Pains with enormous Effervescencies; three sorts of which are describ'd in the Causes of Diseases, the first is from the mildest or best Substance of the Blood, too much agitated or put into too violent a Motion: The Second is from this first matter being more and more exasperated by the same Causes: The Third is from a corrupted or putrefied Bile, which if it arise from the yellow, yolky, eruginous Gall, it is always the worst, and that according to the variety of its Disposition, and the nature of the Part into which it is deposited, various Effects are produced.

The *Blood*, *Serum* and *Bile*, if they are join'd with a predominant Acid, Alkali or muriatic Salt, Oil or Earth produces Diseases, that are agreeable to such as demonstrably arise from these things.

The *Serum* of the Blood, *Bile* and *Urine*, generate from their own matter, Stones that are compounded or made up of a volatile Spirit, Salt, Oil and an Earth from them, united together after a certain manner.

But these by extending in Substance, Weight and Motion, compress the neighbouring or adjacent Parts, and also the Vessels embracing the Stones in their Motion, by the Pressure of their Substance against hard, sharp or rough Bodies, they are broke in pieces and destroy'd; hence the Passage of the Humours is intercepted, Pain is created, *Inflammations*, *Ulcers*, *Gangreens*, *Callosities* and the like Evils, which depend thereon.

The Eggs of *Insects* that are received or taken into the Body with the Air, Meat or Drink, being mix'd with the *Intestinal Pituite* or *Mucus* and with the *Fæces*, lodging in the Cavities, by Warmth and

Rest and Heat, at last Worms are produced, some of which are round or flat or such as are call'd *Ascarides*, and sometimes these are swallow'd down with the common Aliment, from whence growing by degrees, they become familiar and inherent in the Body.

But those by sucking moving about, vellicating and corroding the Guts and consuming the *Chyle*, irritate the Nerves, wound the Solids, and procure *Nauseas*, *Horrors*, *Cardialgia's*, *Vomitings*, *Faintings*, *Leanness*, a canine or voracious Appetite, Swelling of the Belly, &c. especially Wind and sudden Tumors.

An external or internal Force of the moving Bodies, hurts or injures the simple Parts of the Body in every Action call'd mechanical, as hath been observ'd; neither can it be imputed to Heat, Cold, Moisture or Dryness, the Chymical Principles, acrid, alcali or acid.

The Matter or Body of the Disease subsisting in a grieved Part, being suddenly collected is call'd *Fluxion*, but slowly gathering together is a *Collection*; according to the Cause, it owns the Sluggishness of the solid Part not overcoming or expelling that which it began to form, or the Derivation of the present matter erring in the Part, which is now possess'd or inclos'd.

This Derivation, Fluxion, or Attraction call'd by the Antients, is made with Motion, Heat and Pain; and hence Diseases arise which are call'd with Matter.

Poisons, the Plague, contagious things howsoever received, hurt the Solids and Fluids, or both together, so that the Course or Circuit of the vital Humours is stop't; they always indeed act by a mechanical Power, but oftentimes scarce to be understood or sufficiently explain'd, except by the Principles of the Chymists. It is easy to conceive how they hurt

hurt the solid Parts by resolving them too much, relaxing, constringing and obstructing; but they deprave the *Fluids* by inspissating or thickning them too much, and rendring them acrid; hence both together are broken by this united Labour; and therefore they are chiefly swifter in the Nerves, Lungs and Blood; from whence these Diseases thus generated, were call'd by the Antients, *Diseases of the Decay or Loss of the whole Substance.*

And there are certain particular Causes of particular Diseases, which give rise to an ill Conformation of Parts, as the Imagination of the Mother, an imprudent Action of the Midwife, or Negligence of the Nurse or Keeper; for by this means the tender Body of the Infant, being squeez'd, handled, bound or swaddled, is so deform'd, that afterwards it is hardly to be remedied.

So likewise there are evident Causes of the Cavities, being viciated in the ill Disposition of the Parts, whether internal or external; but the Origin of a *Diarefis* is from Extension, Acrimony, or external force.

A strong Compression, a forcible Separation, the Relaxation or Dissolution of the Ligaments, or binding Membranes, produce Laxations, Contorsions, *Hermia's* or *Ruptures*, and a descent or falling down of the Parts.

Cuts, Pricks, Wounds, Burns, Bruises, Contusions, Corrosions, &c. are particular or special Causes of the Solution of unity.

ΣΥΜΠΝΩΜΑΤΟΛΟΓΙΑ ΠΑΘΟΛΟΓΙΑΣ
Symptomatological Pathology.

That Preternatural Thing which from the Disease, as a Cause is made so in the sick Body,
that

that it can be distinguish'd from the Disease it self, and from the proximate Cause of it is call'd *σύμπτωμα*, the Symptom of the Disease, but if from the same Reason, it flows from the Cause of the Disease, it is call'd the *Symptom of the Cause*, but where it is produced from another prior *Symptom*, as its Cause, it is call'd *σύμπτωμα συμπτώματος*, but that which may be over and above added to the Disease, from a different Origin from the former, is rather call'd *παράσυμπτωμα*, *παράσυμπτωμα*, *συμβεβηκός*.

The first Class of these is dispos'd according to the Series, or Order of Actions decay'd, lessen'd, destroy'd, increas'd and deprav'd; from whence occurs an Explanation of the *Symptoms* of the Appetite upon Meat and Drink. Therefore *δυσουρξία*, is a decay'd Appetite, *ανουρξία*, the same lost or destroy'd; *μισουσία*, an Abhorrence or loathing of Victuals; *βέλμη*, *ὄρεξις*, *κυνάδης*, Increase of Hunger or a canine Appetite, *κίσις*, *μαλακία*, call'd *Pica*, a deprav'd longing Appetite or Desire to such Things as cannot be turn'd into Nutrition.

The Causes of these *Symptoms* are frequently found to be in a sluggish viscid Flegm, where the *Bile* is wanting, there is a Suppression of the saline matter, and a Relaxation or *Paralysis* upon the Fibres: So likewise they proceed from the Putrefaction of the *Sordes*, a watry Disposition of the Blood, Fatness, Idleness, an Acid, Saline, bilious Acrimony, Worms in the Stomach or Guts, the too great Strength of the Fibres, continued Motion, a sharp Humour predominating, an Alteration or Change of the Blood's Circulation, deprav'd Imagination, especially in breeding Women.

An unsatiable Desire of Drink and too great Thirst, us'd to arise from excessive dryness, from the Thickness of the fluid Humors, from too much Heat, from a Muratic, Armoniac, Alcaline, Aromatick

matick Sharpness, or biting Quality, or lastly from Poisons.

Manducation or *Chewing* is injured from the vice or defect of the Mouth, Tongue, Teeth, Jaws, *Saliva* or Spittle and Muscles, which may be occasion'd by Wounds, an Inflammation, Palsy, Spasm or Contraction and Dryness.

Swallowing is hurt likewise from an Impediment of the Mouth, Tongue, Palate, Glands of the *Tonsillæ*, the *Uvula*, *Larynx*, *Pharynx*, Gullet and upper Orifice of the Stomach, and this happens by Wounds, Inflammation, Pain, Spasms, Palsy, Dryness, a *χρῆσις*, or a Laxation of the Parts of the *Larynx* or the *Vertebrae* of the Neck, and the Want of *Mucus*.

The first Species of the Action of the Stomach being hurt, are *ἀνέσις*, *δυσέσις*, *βραδυέσις*, *διαρροή*, when the Contents of the Victuals are not digested either in the Stomach, or else too slowly and with difficulty, or they are chang'd from good *Chyle* into a contrary putrid Humor: The Causes are the same almost as the *ἀνέσις*; but principally the Deficiency and Unactiveness of the *Saliva* of the Mouth and Stomach, the languid Organs of Inspiration; the *Sordes* Worms and Flux of putrid Humours; but a quick Digestion the rest being good is seldom a Disease or the Cause of one.

But the Faults of Expulsion from the Stomach are reckon'd to be *Hicups*, *Nauseating*, *Vomiting*, *Choler*, *Ructations*; the first of which is as may be seen a Convulsion of the *Oesophagus* or Gullet, drawing up the *Ventricle* and the *Diaphragm*; while the *Diaphragm* is likewise suddenly push'd down again; the Cause whereof is found to be a sudden swallowing of too much at once; abundance of eating or drinking, Acrimony contain'd in the Stomach, an Inflammation of the *Oesophagus*, *Ventricle* and *Septum Transversum*,

versum, a *Spasm*, from too much Evacuation or an Excess of vomiting and sharp Poisons.

Nausea, or *Loathing* and *Vomiting*, seem to be retrograde, spasmodick Motions of the Muscular Fibres of the Gullet, Stomach and Guts; likewise strong Convulsions of the Abdominal Muscles and the *Septum transversum*, which moving slower, provoke a Loathing, but more violently vomiting. But these are made from too great Plenty or the Acrimony of the Aliment, from Poisons, Wounds of the Brain, Contusions, Compressions, Inflammations; from an Inflammation of the *Diaphragm*, *Stomach*, *Intestines*, *Spleen*, *Liver*, *Kidneys*, *Pancreas*, *Mesentery*; from an Irritation of the Gullet, from a disturb'd Motion of the Spirits, by musical Agitations or in a Coach, Ship, &c. from an *Idea* of something, whereby they are provok'd to loathing and vomiting.

But the Expulsion of *Choler* violently moved upwards and downwards, from the Stomach and Guts, is a Convulsion creating a Vomit, and so likewise a strong *Spasm* of the Intestines downwards, great devouring of Summer Fruits, and hot Weather in the Month of *August*.

Belching is an Explosion of the elastick matter, by a convulsive Contraction of the Fibres of the *Oesophagus*, the Stomach, the Intestines compress'd, and afterwards from a Resolution they are set at Liberty again; but this proceeds from Crudity, Corruption, Sharpness, Summer Fruits, Must, fermenting Liquors, Poisons, Spasmodick Diseases, and all kinds of Acrimony.

But a violated Expulsion of the Stomach and Guts is also to be met with in *acutia* or *Lientery*, which is a sudden Expulsion of the Aliment by Siege or Stool, which being receiv'd into the Stomach, had not yet had time to be chang'd and turn'd into Nourishment; the Cause of which is the Sluggishness or Unactivity of the Humours, as in the *invocētia* and *acutia*.

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are, as also the greatest Laxness of the *Ventricle* and *Intestines*; while at the same time *Respiration* is pretty strong.

If the *Chyle* be cast out together with the *Feces* by stool, it is call'd a *Cæliack Affection*; where the *Stomach* and *Humours* seem to concur, as sufficiently powerful for a constituting Cause, while the *Intestines* are too lax, or the Mouths of the *lacteal Vessels* from some Cause or other are obstructed.

A *Diarrhea* is a frequent and plentiful casting out of liquid Excrements by stool; whether arising from Meat or Drink, or any other *Humours* contain'd in the *Guts*; the Cause whereof is either some acrid matter that irritates the *Intestines*, expressing or squeezing out the *Humours* from the *Hepatick*, *Pancreatick*, *Mesenterick* or *Intestinal Vessel*, while the Mouths of the *Mesenterick* and *Lacteal Ducts* are shut, or else it is a great Laxness of the *Intestinal Fibres*; and lastly, an Impediment or Hindrance to the other Excretions.

A *Dysentery* is a *Diarrhea* with remarkable Pain, the matter of which is the same with that of the *Diarrhea*, but more sharp and acrid, abounding besides with *Bile*, *Serum*, *Blood*, *Intestinal Mucus*, *Pus*, *Sanies*, *Fibres*, *Caruncles* and *Membranes*; from whence it hath the same Cause but more violent, which frequently from the Acrimony of the *Humours* occasions an Inflammation, Ulcer or Gangrene of the *Intestines* or other Parts.

What we call the *Illick Passion*, is a violent Rejection or casting up of whatever is taken by the Mouth, whether as Meat and Drink, or under the Denomination of Medicine, together with a Discharge of *Chyle*, *Bile*, the *Serum* of the *Stomach*, *Pancreas* and *Intestines*, *Melancholy Bile*, *Mucus*, *Pus*, the *Feces* of the *Guts*, &c. The proximate Cause of which Symptom always appears to be the inverted Motion of the *Fibres* of the *Intestines*, *Stomach* and *Oesopha-*

Oesophagus, happening together with some other Cause that may provoke to vomit, but the remote Cause is an *Inflammation*, *Apostems*, *Scirrus*, *Cancer*, *hard Faeces*, *Stone Hernia*, *Convulsion* and *Twisting of the Guts*; from these Effects the Retention of the harder *Faeces* is understood in its Origin, Cause and Nature.

But if the Generation and Excretion of the *Bile* into the Intestines, be interrupted or disturb'd, these *Symptoms* first arise, *yellow Jaundice*, a *Bilious Cachexy*, *Stone and Gravel in the Liver*, *Obstructions*, white, hard and dry Excrements by Stool, the Mixture of what is eat and drank is impeded; there is a *Tympany* and a *Dropsy*, for its Cause it frequently owns the Inflammation, Dryness and Obstruction of the Liver, or of the Humours contain'd therein, and the *Abdominal Viscera*, and the Inspissation or thickning of the Fluids thereof.

But if the *Lympha*, of the *Pancreas*, *Liver* and *Intestines*, be injur'd in the making or Motion thereof, such like *Symptoms* arise as we mention in the *Diarrhea*, because their Causes are alike.

The change of the Blood in the Heart, is according to the *Modus*, the Reception, Slowness or Expulsion thereof; which if too great, as to Motion, produces continued, burning, strong Fevers; but being much slower, and the Expulsion still more languid, then follows a weakness or decay of strength, *polypous Concretions*, cold, *Leucophlegmatic Dropsies*, and several other Diseases proceeding from hence.

A violated Action of the Lungs, as well that which serves for Respiration, as that for Transmission of Blood, consists first, in the Increase or Decrease of its Efficacy on the Blood; from the first seems to arise *διάθεσις φλογιστική* and *inflammatory Affection*, from the latter *αἱματοποιήσις* an Impediment of *Sanguification*, and that of Nutrition; from whence arises a *καχεξία*, *ἀτροφία*, *φθίσις*, that is a *Cachexy*, *Atrophy* and

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and *Phthisick*, with infinite other *Mischief*; but the Cause of that injured Action is every Way or Part of those Multiplicity of Organs, which serve to Respiration.

The *Symptoms* of the Secretion of Urine being interrupted are chiefly these, first, *ixuela Ischuria*, to wit, a total Retention of the Urine that is not at all excreted, the first Causes of which are a *Plethora*, an Inflammation of the *Reins*, *Ureters*, *Bladder*, Neck of the *Bladder* and *Urethra*, a Spasm and Pressure of the same Parts; as also an Obstruction from a *Stone Pus*, *Grauel*, *Caruncle*, *Apoſtem* and *Tumour*.

The Second, is *dyſœia* a *Dysury*, or too great an Excretion of Urine with Trouble, Struggling and Pain, a Species whereof is call'd *œcysœia* or the *Strangury*, where the Urine is emitted drop by drop, with a Sense of Heat; the Cause of either Evil being manifold, to wit first, from the Acrimony of new fermenting Malt Drink, Wine or the *Fæces* or Sedement of either, Acid, Salt, Alcaline, Oleous, Aromatick or Bilious Humours; the Excoriation of the Parts of the *Bladder* or *Urethra* from Inflammation, or some *Ulcer*, from the grinding of a sharp or rough Stone, the taking of *Cantharides*, &c. a Stone or Tumour fix'd in the Neck of the *Bladder*, or the *Urethra*.

Thirdly, Incontinence of Urine, which happens when that flows of its own accord, without the consent of the Will, or the assistance either of that or Respiration: It proceeds chiefly from a Resolution of the Parts consumed by Separation, or from a *Gangrene* putrefying the Fibres of the *Sphincter* of the *Bladder*.

Lastly, the Fourth is *διαβήτης* a *Diabetes*, with a frequent and plentiful passing through of chylous or milky Urine: The Cause whereof is suppos'd to be too great a Relaxation of the Fibres in the urinary Arteries concurring together with the Humours very

very much diluted, both which proceed from watry Blood.

But an injur'd vital Action regards chiefly for its *Symptoms*, the Pulse of the Heart, the Exercise of Respiration, or both together; so that therefore first of all, the Palpitation of the Heart is reckon'd, that which is call'd a violent Contraction thereof, together with a great Resistance of Blood puls'd from the Heart, the Cause of it is oftentimes an inordinate and violent *Impetus*, of the vital Spirits on the sides of the Heart, as in the greatest Passions of the Mind, sudden Fear, Hysterick Affections, a sudden and violent Motion, precipitate waking; sometimes it is an Irritation of the Fibres of the Heart, made from a certain acrid *Stimulus*, as in the *Cachochymia*, the Inflammation of the Heart and *Pericardium*, or from these Disaffections, Stone, Worms, Hair, an *Aneurism*; thence from thickned or congealed Blood, a *Polypus*, at length from cartilaginous or bony Arteries, or from these obstructed at their Extremities.

2ly, The intermitting Pulse of the Arteries happens, either from the ill Disposition of the Liquid of the *Cerebellum* unequally flowing into the Heart, or from the Fault of the Vessels transmitting the Blood and Humours; or else lastly, from the vitiated Humour which flows thro' the Vessels; from whence the Cause of this Mischiefe is various, as *Convulsion*, *Polypus*, *Cachochymia*, an Arterial, Pulmonick or Cardiack Inflammation, a Deficiency of Blood, the Arteries being bony, cartilaginous, subject to *Aneurism*, or stoppt with a Stone, or else the Heart having an ill Conformation from a different Cause.

A frequent Pulse always arises from a quick Systolick Contraction of the Heart; but this is from a more frequent Influx of the Spirits of the *Cerebellum*, and a more difficult Progress of the Liquor expell'd; whereby they become acrid and obstructed.

The

The Diminution or lessening of the *Pulse*, which is reduced to a *λειποθυμία*, or a sinking of the Spirits, where they are so weak that they are scarce able to support the Body; a *λειποψυχία* is a Defection of the Animal Spirits, when they fail so, as to deny the Assistance of the Natural Heat; the *συγκοπή* is where the Heart so deficient, that Heat, Motion and Sense are almost lost, and is attended with cold Sweats; *ἀσφυξία* is a Privation or Want of Pulse, since no Artery appears to move, and where all is lost as to Sense, and they look like the Image of Death: The various Causes of these *Symptoms*, consist in the various degrees of them; as first, horrid *Ideas* of a Thing, Sorrow, Affections of the Mind, Spasms, especially in such as suffer a great Loss of Blood, as in *Child-bearing*, *Abortion*, &c.

An interrupted Respiration or difficulty of breathing, reckons its first *Symptoms* to be first, an *ἀπνοία* a total Deprivation of Breath, or where it intirely ceases, and places its first Cause in the *Lipothimia*, or sinking of the Spirits, also it hath regard to a vitiated Air, poisonous Vapours, caustick, acid and austere Bodies: A *Palsy* or *Spasm* of the Organs of Respiration, destroys altogether the Function or Use of these Parts.

2ly, A *Δυσπνοία* or *Dyspnœa*, in which Respiration is made with Trouble, Pain, and Labour, this is of the same Nature with the former but lighter, whereby it renders the Conformation of the Breast worse than the rest.

3ly, An *ᾰσθμα* or *Asthma*, which is a frequent, troublesome Wheeasing Kind of Breathing; often proceeding from an obstinate *Dyspnœa*, but chiefly as it appears from a spasmodick Constriction of the Muscular Fibres in the *Lungs*.

4ly, An *ὀρθοπνεία* *Orthopnia*, which is a stoppage or difficulty of breathing, with the Neck erect, and the Breast at Liberty, proceeding from the same

Cause with the others, but acting and receding by various Insults or Attacks.

sly, A suffocating *Catarrh*, which seems as if it would kill instantly, and is call'd *anvoia* or a strangling, this hath the same Origin as the rest, but is more frequent or common; for from the inflam'd matter, there is a sudden Distillation falls, upon the *Jaws* and *Lungs*; this is often observ'd to proceed from the greatest disorder of the Nerves, and a large *Poly-pus* of the Heart thrust into the *Lungs*.

But all these *Symptoms*, appear to be produced from some remarkable Causes, by examining of dead Bodies; as first, the Repletion of the *Thorax* by extravasated *Lympha*, *Pus* and *Blood*; likewise the Inflammation of the *Larynx*, *Aspera Arteria*, *Bronchia*, *Lungs*, *Pleura*, *Mediastinum*, *Diaphragm*, and Muscles of the Breast serving for Respiration, as those of the *Abdomen*; and so from the different matter of a *Poly-pus*, *Flegm*, *Chalk*, *Gravel*, *Stones* and *Pus*; together with a Tumour about the *Larynx*, and in the *Lungs*, whether inflammatory or separated, a *Scirrhus* and *Cancer*; and at last an Adhesion of the *Lungs* to the *Pleura*.

The numerous *Symptoms* attending the Diseases of Sight or the Eye, are taken from the Enquiry into their Causes, according to the Diversity of Situation; for first, the coercing or binding Parts affect the Eye by pressing the Bulb thereof, Protrusion, Extrusion, Corrosion, by inflam'd Tumours, *Apostems*, *Scirrhus's*, *Cancers* *Exostoses*, a *Caries* of the Bones, forming the Orbit of the Eye: From whence the Figure thereof, the Humours, Circulation, Sight, Axis, and Collection of the Rays, are deprav'd and loose their proper Office.

From hence also, the *Eye-lids* being inflam'd, separated, inflated, conglutinated and concreted, wonderfully disturb the Sight, from several different Causes,

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Causes, but chiefly and most frequently by the ill Habit or Disposition of the *sebaceous or seuer Glands*.

So likewise from too great Plenty of Tears, that are sharp and thick, arising drop by drop at the Edges of the *Eye-lids*, whence they distill from the Eyes upon the Cheeks; these troublesome Fluids disturb the Sight, cause inflammatory Consumptions of the Part, Dimness of Sight, and what we call *Fistulae Lacrymales*. Those Things happen by reason of too great a Laxness of the *Lacrymal Gland*, or from the Acrimony and too much Motion of the lachrymal Substance, and perhaps from the ill Configuration of the Palpebral *Tar/us*, or from a various Disposition of the little Mouths of the *Eye-lids*, that absorb the Tears, and of the Pipes that convey them into a lachrymal Bag; therefore howsoever they recede from their Natural State, the Channel of the Nose, or the Membrane that invests the Nostrils within, whereby they hinder their Passage out by this Canal into the Cavities of the Nostrils, they err, and are in an evil Disposition.

Hence the Vision is deprav'd, impeded or lost, by darkning, or obscuring and thickning the *Tunica Cornea & adnata*, whence comes an *Oedema Pbylloena*, Inflammation, a Nail, Pearl, Cicatrix, white Speck or Cartilage; all which may happen from various and different Causes.

When the *aqueous Humour* is wanting, there is a flagging of the Eye and the *Cornea* becomes wrinkled; if it abounds or exceeds, there is a protuberant or elephantine Eye, if it stagnates, by not being recruited, but putrefying, the whole Fabrick of the Eye sinks, if it takes a Colour or thickens, whether into the Nature of *Mucus* or *Pituita*; hence arises Suffusions and Cataracts, these are for the most Part betwixt the inward Membranes of the *Uvea* and the smooth *ChrySTALLINE*; and the Cause is chiefly an

Inflammation, Cachychymia, or too imprudent Application of coagulating Things.

If the *Uvea* is inflam'd, there arises a very painful *Ophthalmia*, most pernicious to the Sight; if it is separated, the Quickness and Sight is lost; if it be immoveable and contracted, there arises an *ἡμεγελοπία*, which makes that they can only see at full day, and happens where the *Cataract* is less, thinner at the Edges, and thicker in the middle; but if motionless, and yet very open or broad, then there is a *νυκταλωπία* or an Owl-light Sight.

It is certain, that the *Opacæ Crystalline Lens* being inflam'd, separated, hydropick, decay'd and consumed, produces a *Glaucoma*, a *Cataract*, *dull Sight*, and a cloudy Blindness call'd *αμβλυωνία*, or a heavy obtuse Sight; but if the same is injur'd, in its Figure, Substance, Thickness, or Thinness, it will create many, various, and those often wonderful ill Accidents to the Sight.

Nay the too spherical Figure of the prominent Bulb, and also the Smallness of the *Pupilla*, and many other Conditions hitherto less clearly beheld in the length of the Eye, may produce in the *Lens* it self and its Situation a *μυωνία*, or short Sightedness; as on the contrary in a flatter Eye, from the various Disposition of the *Lens* and its Situation, may arise a *περσβυωνία* or a distant Sight.

The Membranes of the *Retina*, by means of their many different Vessels, can produce great variety of Accidents, as *Dropsy*, *Oedema*, *Phlyctena*, Inflammation and Compression; and so of the optick Nerve, and the Membranes that inclose: Then a *Tumour*, *Steatoma*, *Abscess*, *Hydatides*, *Stones*, Inflammations, Corruptions and Obstructions may so happen to the Brain, that a free Communication is stopt betwixt the optick Nerve, and its Origin in the medullary Part of the *Cerebrum*, or else is intirely destroy'd; all these by different ways strike the Organ with an Imagina-

Imagination of Flakes and Motes dancing before the Eyes; this is call'd *αυαλσμων* a Dimness of Sight and a *Gutta Serena*.

A *Palsy* or *Spasm* of the Muscles that move the Eye, the Distractions or various Contortions arising from the Bones of the Orbit ill dispos'd, as also Wounds, Ulcers, Inflammations and Compressions, may produce the *πινωστας*, or *squinting Eye*, and such like strange Disaffections.

At last, the *Tunica Choroides* of *Ruyseh*, and the *Uvea* abounding with Blood Vessels, are very lyable to Inflammations and Separations, so that they easily produce an *καυρωσις* or Suffusion; and from the various Diseases of the different Parts in the Eye, frequently occasion Confusion of Sight, Dimness, and at length Blindness.

The first *Symptoms* that are reckon'd in the Diseases of the Ear, are an Increase or Decrease, a taking away or a deprav'd *Hearing*.

In the acutest Diseases of the *Brain*, *Nerves*, and *Membranes*, it appears in these, as if too tense, or too much stretch'd, that there frequently arises almost an intollerable *ὑψηλοτης*, Acuteness or Quickness of hearing, affecting the Brain strongly with the smallest Sound, and exciting, sometimes convulsive Motions.

That is call'd, *βαρυνθια* or a thick, dull hearing, when the Perception of the Sound is less than the Size, that is requir'd in Health; but it arises from very many and those various Causes, commodiously situated according to the various Places affected; for the external Parts of the Ear may be too plane or flat or taken away; the *Meatus Auditorius* too strait or narrow, obstructed with some Tumour, with *Insects*, *Pus*, *Sordes* or concreted Wax: The Membrane of the *Tympanum* may be wounded, relaxed, callous'd, or cover'd with a fungous, spongy, thick Crust; the internal *Concha* may be fill'd with *Ichor*, *Pus*, or

Rheum, with Tumours of the Membrane investing that on every side; *Eustachius Canal* may be stop't or obstructed from the falling in of Dust or the like, after the breaking the Membrane of the *Tympanum*, the *Officula* loos'd or broke off from its Connexion, and carry'd thro' the *Meatus*, or from the Separation of the little Membrane, as it often happens after cruel inflammatory Pains of the internal Ear, or when the *Officula* is wanting by reason of an ill Conformation of the Part: So likewise Dryness Relaxation, Thickness, an Inundation or overflowing of Moisture, too great Tension, Corruption or Induration of the little round Membrane of the *Fenestra* and *Ovalis*, the *Vestibulum*, *Labyrinth*, *Cochlea* and *Meatus* of the *Os petrosum*, the various Vices, Inflammations, Obstructions, Palsies, and those which may derive themselves from thence as from their Causes, and also the contrary of them from the Structure of the hearing; lastly, from every Impediment whereby the soft Auditory Nerve may be stop't or hindred in the middle way, from its Entrance into the *Os Petrosum*, even to the *Medulla oblongata*, or hence, even to the Origin in the *Medulla* of the Brain, as Inflammations, Tumours, *Exostoses*, a wounded Function of the *Cerebrum*, and many Diseases besides, from whence we may find the difficult Reason for the Cure of them.

Likewise from the Vice of the external Ear, chiefly the humid, and cloudy, or that of the internal, not having free Passage in or out, there happens a depraved Hearing; first of all, these little Arteries are damag'd, which supply the small Membranes that are dispers'd every where, in the whole Organ of Hearing, from whence is easily understood the Reason of the tinckling, humming, murmuring, still Noise in the Ear.

If at length all these Vices continue to increase, then arises a *κωφωσις*, or perfect Deafness; from whence proceeds

proceeds the Ignorance or Forgetfulness of Speaking, the Cause whereof is often a Concretion of *Eustachius's Tube*, and frequently in the Venereal Disease from the ulcer'd, rotten hollow Jaws, from thence by Reason of the Crudity of their Lips, united with the Concretes.

Smelling is also lessen'd or quite lost, ; first, from the Defect or Solidity of the four Spungy *Ossicula* or little Bones, and the smallest caverns or hollows in the *Os frontis*, the upper *Maxilla*, and the *Os Cuneiforme*; 2ly, From the Dryness, Moisture, Inflammation, Separation or Gangrene of the olfactory Membrane. 3ly, From the compress'd olfactory Nerves by certain Tumours created here with *Exostoses* and *Polypus's*. 4ly, From Vices in the Brain to the Origin of those Nerves, as hath been said before in the other Senses, it is also deprav'd from a stench of some matter, resting upon these cavernous Places, and continually exhaling.

The *Taste* is likewise diminish'd, taken away or deprav'd : The first Two of these will happen, if the tasting *Papillæ* of the Tongue be cover'd with a Crust, Foulness, Slime, Thrush, Pustules, Warts, Inflammation and Dryness, or an accidental Wounding of the Nerves, of the fifth Pair: But this Sense is deprav'd from the Vice of the predominant Humour, first, that often sticks in the *Saliva* pour'd into the Mouth, which erring in Taste, produces here many Effects of a bilious, alkaline, acid, saline, æruginous, oily, saccharine, or cadaverous Nature.

The Sense of *Feeling* us'd to be injur'd, first, by a *Stupor* or Numbness that was scarce perceivable, or at least blunt or obtuse, as it were by a *Medium* interposing ; which happens from too great a coldness of the extrem Organ, or from a Defect of the Nerve or Brain, as by an Interposition of some matter, unapt or improper to that Sense; from thence in too acute a Sensibility, or perhaps from too much stretching

and Softness of the Nerve together, likewise from a lost Faculty of touching from any Cause, whereby the Nerves, Brain, or both, are render'd unapt for performing their Duty, as may be seen in the *Aplexy* and *Palsy*.

Waking or *Watchfulness* rises first, from too great a Determination of the Nervous Fluid, to the Organs of Sense: 2ly, From too sudden or violent a Motion thereof towards the Brain, the Inferior Parts being obstructed by Cold, or any other Cause, as in hypochondriack, melancholy, mad Persons, who are cold in the lower Parts. 3ly, From some Irritation wheresoever seated, that vellicates the Organs of Sense, especially the Brain. 4ly, From too great Motion of the Fluids, where the *Meatus's* or Passages of the Brain are open. 5ly, From Diseases, in which these Things mention'd before, are predominant, as from *Fevers*, *Frensies*, *Melancholy*, *Grief*, *Separations*, and the like.

But too much Sleep may arise from any Cause, that stops the free Flux and Reflux of the Spirits, from the *Medulla* of the Brain, by the Nerves to the Organs of Sense, and of the Muscles subservient to the Will, and then again, from these to the Origin of these Nerves in the *Medulla* of the Brain: But this Cause is still manifold, yet easily referr'd to a *Plethora*, *Obstruction*, *Effusion* of Humours, the *Compression* or *Squeezing* of the Vessels, *Inflammation*, *Separation*, *Gangrene*, *Slothfulness*, the Use of *Opium*, *Narcoticks*, *Aromaticks*, Fermenting, spirituous Things, too much apply'd to the Nose, hard Meals, Fat, and to great Quantities lodging long upon the Stomach.

Κῶμα ἀγρυπνίας, *Coma nocturnæ Vigilæ* is an unsurmountable Inclination to Sleep, with a perpetual and terrible Twitching in Sleep, which derives it self from the like Causes as the former, but is attended with a great Stimulation of the Parts, frequently

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quently proceeding from a violent Inflammation that happens to be join'd with it. *Κατὰ νύκτα* a continued Sleeping, with as continued a Relapse into the same Condition upon Waking. *Κατὰ νύκτα*, *Κατὰ νύκτα* is a profound Sleep with a sudden Loss of Sense and Motion, together with an acute Fever and a Difficulty to be wak'd, this is but a slighter kind of *Apoplexy*. *Λήθαργος*, *Lethargus* or *Lethargy*, is a deep, quiet, forgetful Sleepiness, proceeding from a slow, cold Cause, in many things much like the rest, and frequently arising from the meeting together of several such like Causes. A *ναλαργος* differs scarce at all, or very little from the former.

Ἀναισθησία, a Faculty of perceiving the Actions of sensible Objects in the Organs of the external Senses taken away, of which there are different degrees, Stupidity, Dulness, Confusion; the Memory more or less taken away or confus'd; an imperfect Faculty of Judging, lost or confus'd; an imperfect Faculty of Reasoning, lost or disturb'd; *Delirium*, Folly, Madness, a depraved Imagination, and all Diseases may be refer'd hither, that depend on many and various Causes, yet so that they may be properly derived from these, Age, Affections of the Mind, the Rigidity, Laxity, Concretion or Deletion of the Solids: The Thickness, Acrimony, Thinness and Unactivity of the Fluids, may be discover'd as the Principle amongst others.

Ἀποπληξία, the *Apoplexy* is a sudden and intire Loss of the Senses, external and internal, and also of all voluntary Motion, yet with some continuation of Breathing and a Pulse; its Cause is seated in the Brain, which hinders or stops the Flux of the Spirits, from the Origine of the *Medulla* of the Brain thro' the Nerves thereof; this is many ways, and may be fitly enough refer'd to all those which compress the Brain, outwardly or inwardly, being reducible to Five Classes. First, *Fractures*, *Impressions*, *Exostoses*,
Tumors,

Tumors, Compressions of the Cranium, first of all, in Youth and Infancy, when it is yet soft and tender. 2ly, The Humours of Blood, Serum, Pus, Flegm, Sanies, either stagnating or pour'd out into those Places, where they may be compress'd, or corrode the Brain and its Membranes; as betwixt the *Skull* and the *Meninges*, betwixt these and the Brain, in the Ventricle thereof, to the *Medulla oblongata* and *Medulla spinalis*. 3ly, Inflammatory, aqueous, serous, purulent, mucous, scirrhus, stony Tumors, in the same places, and subject to the same effect of Compression. 4ly, Impediments from a Flux of Blood running to the Brain, especially from a Fault of the Vessels being wounded, compress'd or obstructed from a *Polypus*. 5ly, The like Impediments rising in the little Veins, *Sinus's* and larger Ducts, in which the sanguineous Humour returns from the Brain; but these Impediments how great soever, proceed from the Compression of the Veins,

Παράλυσις, a *Palsy* renders the flaccid Muscles motionless, the Cause whereof is a Stoppage of the Influx of the Spirits into the Texture of the Muscles, or of the Arterial Blood into its Vessels; this happens from a Fault in the Brain, Nerves, the Muscle it self, or its Arteries.

Παραπληγία, is a Loss of Motion of all the Muscles under the Head, which have their Nerves from the *Cerebrum* and *Cerebellum*, issuing from under the *Cranium*; the Cause therefore chiefly lodges in the Fourth Ventricle of the Brain, or at the Beginnings of the spinal Marrow.

Ἡμιπληγία, *Hemiplegia* is the same Disease, but only that it seizes one side of the Body; hence the Cause is the same, but it derives it self only from one side of the Brain, or the *Medulla spinalis*.

Παράλυσις, or the *Palsy* of a particular Part is clearly known; and therefore we understand, why in the *Apoplexy* there is likewise a *Paraplegia*, or at least

least a strong *Hemiplegia*? also why upon the removing of the *Apoplexy*, neither of these succeed, or if they do, they last not long.

Ἐπιληψία, the *Epilepsis* or *Falling Sickness*, is a sudden and intire Deprivation or Loss of the Senses external and internal, and also of voluntary Motion, together with reciprocal and violent Convulsions, and a Return from them; from whence here seems to concur a double, and as it were opposite or contrary Cause, partly *Apoplectick*, and partly *Comatous*, acting by turns, but neither so strong, nor continuing so long a time.

Λίγος, a *Vertigo* or *Swimming of the Brain*, making as if the Objects turn'd round, and a Trembling of the Limbs, proceeding from an *Apoplectick* Cause, but not so severe.

Σπασμὸς, a *Spasm* or *Convulsion* is an unwilling, violent Contraction of the Muscles, with the attracted Part also hanging to the Muscle: The Cause arises from a strong and continued Influx of the nervous Fluid into the Muscle, of which there are infinite Causes in the *Blood, Arteries, Meninges, Brain, Nerves, Muscles* and *Cranium*.

Τέτανος, or *Rigor*, is an involuntary, violent Convulsion, being disagreeable to the bending and extending Part of the proper Muscles, which is either universal of them all together, or singular of one certain particular Limb or Member.

Ἐμπροσθότονος, is a *Spasm* of the Muscles, bending forward the Head, Neck, Breast and Loins.

Ὁπίσθότονος, is a *Spasm* of the Muscles bending backwards, the Head, Neck and Back; and it appears easy to prove, that the Cause of the latter is one and the same as that of the *Spasm*, but more universal, and almost always subtil, sharp and poisonous.

Hence 'tis plainly evident, why a *Vertigo* and *Convulsion*, first of all being universal, the *Falling-sickness*,

febrilis, if great and obstinate, and from an internal Cause, almost always terminate at last in the *Apoplexy*.

A vitiated Quality of the Body, is call'd that which hurts or annoys the Disposition, that extends it self to, or mixes with the Senses; but this is chiefly to be consider'd as to Colour and Smell.

The Colour of the *Skin*, the *Cuticle*, the *Tunica adnata* of the Eye, the *Cornea*, Lips, Mouth, Tongue, Jaws and Caruncles of the Eye being pale, yellow, green, livid, red or black depends on the like Bodies, shining thro' the pellucid Vessels, and as they are mutually received in a various Series or Order, and also claim different Causes, as appears in the *Phlogosis*, or particular, Inflammation, *Gangrene* and *Sphacelus*.

The pale, red, yellow, black or brown Colour of the Bones, appears from a Contusion, Inflammation, Abscesses, a morbid *Medulla*, the taking away of the *Periosteum*, a *Caries* and *Spina ventosa*.

But a Smell or Stench arises from stagnating, corrupted or venemous Humours, and that from every Cause which attenuates the Oils and Salts too much, and renders them too volatile, as Famine, Heat, too great Motion or Acrimony of what is eat and drank.

ΣΗΜΕΙΩΤΙΚΗ Σ.

The Semeiotical Part of Physick, being first General.

SINCE a Disease is an Effect depending on its Cause, it is a particular *Ens* or Being distinct from all others, and therefore ought to be accurately understood in its own proper and singular Nature, that

that it may be cured ; which will appear to be necessary in *Health*, and the various State and Condition thereof.

But the present Nature of *Health*, or its Defect, a *Disease*, rarely appears in the Senses by it self, neither is it so conspicuous by it self, where being present in the Body, they may be known ; but the reason of both frequently lies hid.

But from the Presence of either, there are certain Effects depending, on the Exercise or Performance of the salubrious Functions, or on the Impediment of them : These are indeed distinct from those Causes, but yet so depend upon them, that they manifest their Nature or Disposition, and since they are observable by the Eye of the Senses, they may afford great Light to these Enquiries.

But besides the Knowledge of the applying Cause observ'd in any Part of the Body, which in *Physiology* first teaches the known Nature of the Effect which follows from thence, whether that be salutary or pernicious or future ; neither is it of great moment, whether this Cause be external, internal, natural, accidental, salutiferous, morbid or mortal.

These related Effects furthermore, and the said Causes inasmuch as they are taken to be Sensibles, or how nearly deducted from thence, are call'd *φαινόμενα*, *Phænomena*, or *Appearances* ; but these us'd to be call'd *Signs*, when from the Observation of them in Sense, by the Law of right Reason is demonstrated the Presence, Nature, Condition and Event, as well of *Health*, as of a *Disease* and *Death*.

Those things are call'd *διαγνώσις* or *ἰατρικὴ*, when they declare or pronounce the present State and Condition of the living Body, healthful, sick or dying ; but if they pronounce what shall happen hereafter, then they are call'd *προγνώσις*, or *Prognosticks* ; but where they proceed, and at last come within

within the compass of our Knowledge, they are term'd by Physicians *αἰματισινά*.

But in Diseases that declare, the Sign which is proper to the Disease and inseparable from it, as arising from the Nature thereof, that is call'd *πρόσθεν*, or the *Pathonomick Sign*.

Hence the Knowledge thereof is so highly necessary and useful, tho' often difficult in the Enquiry, yet it is always present in the Disease, as long as it keeps its natural Course, and is frequently manifest, when there is a Complication of several concurring Signs.

But those Signs which teach us the Alteration and various Conditions of a Disease, are call'd by the Name of *ἐνδοθεν* or *Symptoms*.

The Efficacy of which is so powerful to the well-understanding and the Cure of Diseases, that there is scarce any other that brings such Advantage to the Practice of Physick, from whence also arise the greatest Mischiefs in the Neglect of them.

But since all these are Effects produc'd from the Cause of a Disease in the Disease it self, and the *Symptoms* daily chang'd; therefore they observe in Diseases the present Condition of its Matter at some certain time, which first produced the Disease, or of that which was produced from the Disease; wherefore they may be assign'd to these three *Classes*, which are

First, Crudity and Digestion.

2ly, The Termination thereof in Health, a Disease or Death.

3ly, Secretion, Excretion and the digested matter, which are therefore call'd *Decretoria vel uelina*, *Decretory* or *Critical*.

General

General Signs of the best State of Health.

These ought to be expected or required from the Actions of the Body, being exercised with *Ease, Use, Pleasure* and *Constancy*; The first Three of which Conditions may be found easy, but the Fourth more difficult; for the great Constancy is only known by those Signs, which indicate that there will be a future long Life in that Body; and hence also from the same reason they frequently pronounce a firm State of Health.

But all those Signs of long Life, are the Effects of the Disposition or Nature of the whole Machine, as to the Solids and Fluids, from whence in the first place the Durableness thereof depends as to the intricate *Compages* or Structure; but this is the Reduction of the Aliment into the like nature with those things that now make up the sound Machine.

By the Assistance of a tedious Observation, these Signs may be reduced to those *Classes*.

First, To *Generation*; a Conception from healthful, vigorous Parents, of full Age, rarely using *Vener*y, but that with Heat, and in the Morning after sound Sleep, and in Spring time, that being chiefly salubrious.

2ly, To Bearing in the Womb; the pregnant Mother being sound, using her Body to laborious Exercise, having a quiet Mind, and only carrying one *Fetus* or Burthen in the Womb, that it may have Plenty of wholesome Food.

3ly, To the Birth, the Child being born after Nine complete Months from the first Conception, and especially coming into the World in *December, January* or *February*.

4ly, To the *modus* or manner of the Body's Growth, it being slow and proportionable in every part, still increasing in Substance and Strength together,

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gether, to the Twenty fifth Year of his Age and upwards.

5ly, To the Habit or Shape of the Body; a broad, large Chest, the *Abdomen* tight and small, the Shoulders, Arms, Thighs and Legs strong, muscular and hairy; the *Cranium* large and capacious, especially the *Occiput*, the Skin hard, and the Body fleshy, but not fat.

6ly, To the Humors, a florid but thick Blood, which when extravasated, is fibrous and strong, and will soon congeal into a hard Substance, the rest of the Humours shou'd be plentiful and tough, moderately hot, less oily and soft.

7ly, To the Actions; a slow, large, full, easy, even Respiration, with the least apparent Alteration of the *Pneumonick* Organs; a slow, large, full, equal, strong, constant or steady Pulse of the Arteries, nor usually changeable from a small Cause, a slow Provocation to Stool, the *Fæces* being of a good consistence with Inconvenience to the Body, little Urine but well digested, rare Sweats, sound Sleep that is refreshing, a greedy Appetite with easy Digestion, moderate Labour, a dull Genius and not too violent Motion of the Mind or Body, with a Constancy to accidental Changes.

But that the Fabrick of the Body may be fit to exercise its Actions easily, usefully and pleasantly, is to be discover'd, first, From the very Tryal of the Senses. 2ly, If the Signs are present after the manner they have been explain'd. 3ly, If the solid Parts are found to be strong, tough and elastic, as to the Matter of which they are formed; if they are knit together after such a manner, in such a situation and proportion, that the proper, as well as common Motions of the Body may be expeditiously and easily perform'd, as well in the Solids as the Fluids. 4ly, If that be the Nature of the Humours, which produces intestine, circulatory, secretory

The Signs of a particular State of Health.

tory, nutritive and excretory Motions, without
equality, and without the Effects of this. And
indeed the most evident Sign that teaches that
equality is there, is the Absence of Pulsations, Tu-
mors, Pains, and Heat. 5ly, If that is the result
of the Union betwixt the Mind and Body, from
whence proceed moderate not violent Passions. 6ly,
If there is a rosy white Colour, or of a good
looking black, the Heat be moderate, and a Lightness
upon the Senses. 7ly, The great Strength of resist-
ing all Causes of Diseases.

But the greatest Power of overcoming the par-
ticular Cause of this or that Disease, whether poi-
sonous or contagious, does not always denote the
most perfect Health, but the contrary, as is clearly
evident in contagious and venemous Diseases.

The Signs of a particular State of Health.

THE best singular Condition of every *Viscera* is
known by its Action being found ready, apt
and regular in the performing its Effects; which
since in *Physiology* they are so largely explain'd,
they may easily be refer'd to that, with the justest
Reason.

But *Health* is a Condition that lodges in the
whole Texture of all the Body together, consisting
of Solids and Fluids; therefore this is particular to
every Man, and consequently is only such as it is
from the Nature of every single Body; hence there-
fore the various Bodies which differ so much, as
well in Solids as Fluids, yet may be singularly or
distinctly healthful; from this the Antients call'd it
ἰδιοσυγκρασία, an *Idiosyncrasy*, or the Health of the
Temperament or Constitution, which would be
more difficult to determine to singular Heads; but
yet the Division propos'd by the Antients, into a hot,
cold,

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cold, moist, dry, bilious, sanguine, flegmatick, melancholy Temperament, hath its Use in Physick.

The Signs of a hot Constitution are describ'd to be yellow, gross Hair abounding throughout the whole Body in great Plenty; a reddish Colour of the Eyes in the white Part, very red in the lachrymal Caruncles, the Face, Lips and Mouth; the Body slender, agile, robust and hot; the Pulse large and quick, addicted to Passion, but of short continuance: In these the Vessels seem to be robust, the *Viscera* strong, the Humours very moveable and fibrous; in which moist, diluting and well temper'd things are serviceable, but if too hot and dry, very injurious to the Body.

The Signs of a cold Constitution are just the contrary; the Hair is thin, the Complexion pale, the Body gross, slow, weak, cold and easily subject to swell, the Pulse is less and heavy; in these the Humours are soft, wat'ry and pituitous, the Solids lax and flabby, corroborating warm things are useful, but the cold and moist relax.

The dry Temperament hath a near relation to the hot, especially if attended with Leanness; the Vessels are here contracted, the Moisture is very little, and that almost acrid; therefore it is very advantageous to the dry Constitution.

A bilious Temperament is describ'd by Plenty of black curled Hair, Hardness and Leanness of the fleshy Parts, by a brown Complexion with large Veins, a great quick Pulse, Obstinacy and Anger; in these there appears to be a greater quantity of the Solids than the Fluids; the hot and dry Medicines are hurtful, but the moist and cooling profitable.

But a sanguine Constitution is distinguish'd by fine flaxen or light brown colour'd Hair, soft Flesh and abundance of it, large blew Veins, distended with Blood, a rosy Complexion, Anger and a Readiness

diness to Action, Evacuatories and temperate things are serviceable to these, but heating stimulating things injurious.

Likewise the flegmatick is depicted with a greater Smoothness of the Skin, white thin Hair that grows but slowly, a white, tumid, soft, fat Body, narrow Veins that lie obscure; in these the Blood Vessels seem to be strait, but they are more extended in the cold Constitutions; hence moist and cold things are chiefly pernicious, but whatever heats, strengthens and dries is assisting.

Lastly, the Indications of a melancholy Temperament are Baldness, black Hair, great Leanness, much Dryness, the Complexion for the most part black, they are constant in their Inclinations, remember Injuries, and have great Penetration in Knowledge; wherefore in these the Vessels appear close, strong, the Humours are dense and tenacious, not easy to be divided or chang'd; hot, dry and acrid things are most hurtful to such, but they are relieved with all moist'ning, cooling, relaxing, emollient, gentle Dissolvents.

The Signs of Diseases.

THE Signs of a future Disease are known or discover'd first, from the unusual Change of certain Functions, especially if the Perspiration of *Sensorium* be lessen'd from an unaccustom'd Weariness, and a sensible Weight or Heaviness in the Body. 2ly, From an accurate Knowledge of the Temperament in every Man, and also from the particular Structure of every Body. 3ly, From the Observation of *Classes*, in which are contain'd the Procatartick Causes. 4ly, From the certain Knowledge of Epidemical Diseases reigning at any time.

The Signs of Diseases that are past, are learnt from their known Effects, that are left behind after some Injury of any solid Part, or the consequences of the offending Humours, or after some Actions that are interrupted; for he that considers the Use of the Parts in Health, knows the Defects that remain, from whence he conceives the nature of the Disease.

The Signs of a Disease present, have regard to the Causes, Nature, Symptoms, State and Event thereof.

The Signs indicating the nature of the Cause of a Disease, are discover'd, first, From the Observation of these things, which apply'd to the Body, constitute Diseases, or by Application make them, as we may see in the *Ätiological Pathology*. 2ly, From the *Idiosyncrasy*. 3ly, From the observ'd Nature of the Effects meeting in the Senses.

A Disease of the solid Part is known, first, From the strength, quality and manner of Application, from the Duration of the Cause whether internal or external. 2ly, From the sensible Change of the Qualities, Situation and Connexion of the Place affected. 3ly, From the wounded Functions. 4ly, From the Excretions produced from the Place affected, directly or obliquely.

Wounds, Contusions, Corrosions, Burns, if apparent to the Senses, are known thereby. But the Condition and State of these is known, first, From Sight or looking upon them. 2ly, From the nature of the Part injured; and 3ly, From the Symptoms.

The Event of them is presaged; first, From the Necessity of the Function hurt, to Life or Health. 2ly, From the nature of the wounded Part. 3ly, From the very manner of the Wound. 4ly, From the Temperament or Constitution of the Patient.

Ulcers, *Fistula's*, *Scirrhus*, *Cancers*, *Inflammations*, *Gangreens*, being apparent to the Senses, easily shows that

that they are known by their *Pathognomick Signs*, which are contain'd in the very Definition of them. But the State of them is known, first, From Inspection, Taste and Smell. 2ly, From the nature of the Part injured. 3ly, From the Observation of the *Symptoms*.

But the Event is presag'd, first, From the nature of the Mischief. 2ly, From the nature of the Part, and its consequence upon Life or Health. 3ly, From the Vicinity of other known Parts. 4ly, From the difficulty of giving Relief. 5ly, From Constitution.

But these Evils lie within, hid from the Senses, they are yet to be discover'd, by enquiring into the Signs. First, From the nature of the Cause. 2ly, From some Function that is hurt or impeded. 3ly, From the Excretions. 4ly, From the Place affected, known by Anatomy, whether internal or external. 5ly, From the sensible quality of the Part that is affected.

The Place affected in Diseases, if external, hath most commonly Signs, that lie open to the external Senses, from whence it is easily detected; for there are many of these, as *Wounds, Contusions, Inflammations, Oedema's, Ulcers, Gangrenes, Luxations, Distortions, Fractures, Caries, Atrophias, Scirrhus, Cancers, &c.* likewise a comparing of the Function injured with the Origine of that Instrument, whereby the Action is made whole, teaches us the Seat of the Disease.

An internal affected Place, appearing more difficultly from an internal Cause, is yet discoverable. First, From the known Nature of the Cause. 2ly, From the injured Function. 3ly, From the Nature of the Disease. 4ly, From the Excretions. 5ly, From the Symptoms being well known and compared with the Anatomical Knowledge of the Parts; for from these Five Fountains, internal Diseases are more particularly known, such as lurk or

lie bid in the *Brain, Nose, Face, Breast, Pleura, Mediastinum, Pericardium, Lungs, Heart, Diaphragm, Liver, Spleen, Stomach, Pancreas, Mesentery, Guts, Reins, Ureters, Bladder, Urethra, Womb and Parts of Generation.*

The Signs of an acute Disease proceeding from the Humours, are taken, first, From the Celerity and Violence of the Increase of the Disease it self. 2ly, From the Vehemence of the Symptoms. 3ly, From the wounded Functions. 4ly, From the things excreted. 5ly, From an Epidemick Constitution. 6ly, From the Season of the Year. 7ly, From the Age, Sex, Life and Temperament of the Patient.

If all these Signs are strong, they pronounce great Danger, but if lighter, they promise some Good.

Again, the Signs of an Acute Disease in the Fluids, which define and presage the Condition, Danger, Duration and Event, are understood from the observ'd Effects depending on our vitiated, or deprav'd Humours.

The Signs of Acrimony in the Humours are, first Pain without any Signs of an increased Motion; and without any apparent Obstruction, as the eating or wasting of the Parts without any manifest Tumors.

The Signs of an alkaline Acrimony, are a stinking Cadaver, smelling in the whole or in part, the Sapor of Flesh, or putrefied Urine eating away of Flesh of an ash, lead or black Colour, and that increasing swiftly by degrees, a lost Appetite abhorring all sorts of Meat, the *Fæces* thin, shining, cadaverous, brown or black, the Urine acrid, thick, brown and frothy, fetid like that of Putrefaction, and scarce letting fall any Sediment, little or no Sweat, or else like the Urine describ'd, the external Skin dry, and the inward Part of the Nostrils,
Mouth,

Mouth, Tongue, Jaws, the Blood thin, broken, florid and scarcely adhering together, little red Pustules, that have matter in them of brown, black or lead Colour, Boils, Bumps, Purple Spots and sharp Inflammations.

The Signs of an acid Acrimony, are Sourness to the Smell and Taste, a pale Colour of the Face, the Corners of the Eyes, Lips, Mouth, Gums and Jaws, a slow waisting with Paleness, the Thirst not great, the Appetite often large, Digestion quick, a strong Desire to earthy and absorbing things, Gripes of the Belly with Paleness and Cold, green, sour, griping Stools, the Urine coming slow, thick and white, with a gross plentiful Sediment, much Sweat, and that acid, Laxness of the Skin, and thick and sometimes pale colour'd Blood, sometimes blacker, slight Inflammations, &c.

The Signs of a muriatic or armoniac Acrimony, are salt Tastes, gentle, slow Erosions that are scabby and leave a Redness, a constant great Thirst scarce to be quench'd, Dryness, Rigidity, salt Urine, slowly putrefying with a thick Sediment, and a thin, fat or oily Pellicle swimming on the top.

The Signs of an oleous putrefied Acrimony, are an Empyreumatick Stench, a bitter or rancid Taste, a sour fat as from burnt Oil, ulcer'd Jaws, a hot waisting of Flesh, Loathing of Meat, an Appetite quite lost and that with Horror, the greatest Thirst, fat and stinking Excrement that appear very scorching in Evacuation, scalding, ferid, frothy Urine that is little in quantity, a dry Skin and Mouth, Heaviness and Oppression, Inflammations that are acrid, sudden and obstinate, Suppurations of the like nature, and fetid Gangreens, all which are relieved by cooling, acid, watry Remedies.

The Signs of too great a Fluidity, are the Perspiration of *Sanctorius*, Sweat, Urine and *Saliva* being too much increas'd, a Waisting, Contraction, Weak-

ness and Thirst throughout the whole Body, which is assisted from inspissating Medicines.

The Signs of too great an Increase of the Hardness of the Body, are Tumors, Pain and Anxiety, the Hindrance of Circulation, Secretion and Excretion, a *Lentor* of the circulating, secreting and excreting Humours, if attended with a Coldness, shows a pituitous, but if with great Heat, then a gross or hard Inflammation, from whence also the Signs of Water, Salt, Oil or Earth predominating are observ'd.

But if, together with the foresaid Signs, all these Signs of Life and a vigorous Circulation appear together, then it declares the quickest and utmost Destruction, but the contrary Signs demonstrate the opposite.

From weighing all these well together, are understood the Signs of Malignity in acute Diseases; for since this signifies the quickest Change of a Disease into Death, these things may be collected, first, From the strongest swiftest Causes apply'd to the Body, as are *Plague, Poison, Fire*, and Putrefaction or Corruption. 2ly, By Observations from the known violent Nature of a predominant Epidemick. 3ly, From the known natural and morbid Constitution of the Sick. 4ly, From an obstinate Resistance or Refusal of all sorts of Medicines, tho' endowed with full Strength to change the Disease. 5ly, From ill *Symptoms* which show that the vital Actions are particularly hurt or injured, such as are in the first place, unquenchable Thirst, Dryness, Foulness, white, yellow, brown and black Colour, especially furr'd in the Mouth, Nostrils, Tongue, Jaws and Palate, intire Loss of Appetite, a constant *Nausea* and Vomiting, Hiccup, Pain and great Uneasiness about the Stomach, a continued puking of *Serum, Gall* and putrid Humours by Vomit, Evacuation of loose fetid Stools, very much weakening the Fibres, Caruncles

runcles and Membranes that are exercis'd in their Discharge, a very thin, red, frothy Urine, made in small Quantities; cold clammy Sweats about the Head and Neck, a quick, weak Pulse that is hard, uneven and intermitting: Sudden, difficult and obstructed Respiration, with Coughing and Pain; Loss of Sense, Delirium, Raving, no Sleep, but what is labour'd and disturb'd; Excretion or Voiding of Blood by Stool or Urine; small Drops of Blood distilling from the Nose; unusual Tremblings of the Tongue, Lips and Hands; strong Convulsions, constant falling down of the Limbs and Head, with a sort of careless hanging down of the Legs and Feet from the Bed; a wild, wandering, fix'd Look of the Eyes; a gathering up or folding of the Bed-cloths, labour'd and solicitous Palpitations, Purple Spots, &c.

Acute Diseases that are to be overcome by Nature or Art, are judg'd so, from the Absence or Want of these Signs; and the contrary, Crudity, Concoction, a Crisis, the Event towards Health, another Disease or Death are the Objects and Signs of a Prognostick in Diseases.

The matter of a Disease which is endowed with that Substance, Figure, Cohesion, Moveableness or Inactivity, that makes or increases the Disease, is call'd *crude*.

But that State of the Disease in which it is so, is call'd the Crudity of the Disease, which obtains equally as well in Diseases, where the whole Mass is infected, as in those where one Part is over-charged with such a matter; which is the same thing in the Solids.

That *Crudity* is known, first, from the Vigour of the Disease continuing or increasing. 2ly, From the daily Increase of the Symptoms. 3ly, From the Exercise of the Functions very much impair'd. 4ly, Best of all from the Recess of all the circulating, secreting,

secreting, excreting and excrementitious Humours, from the sound State of the Body as to Quantity or Quality: From whence it is indicated or shown in Sweat, Tears, Mucus, Saliva and Sputum thrown up by Vomit, in Bile, Faeces, Urine, Corruption, Blood, Menstrua, Lochia, Milk, an Abscess and in sore Throats.

But if the matter of the Disease being first crude, is by the Actions of Life, its peculiar Nature, or proper Remedies so chang'd as to Substance, Figure, Cohesion, Motion, Inactivity, that it recedes less from a salubrious State, does less harm, and therefore lessens the Violence and Strength of the Disease, it is now call'd *Concoction* or *Digestion*.

But that State or Condition of the Disease, in which these things are thus perform'd, is call'd *Digestion*, *Maturation*, or a *παρασκευα*.

That State of the Disease and its matter is known first, from the rest of the Disease and its Decrease, the Strength of Life, in the mean time remaining or increasing. 2ly, From a ceasing or lessening of the *Symptoms*, with the concomitant Vigour of Life: 3ly, From a Restitution of the Functions whole again. 4ly, From a Similitude or the Likeness of the circulating, secreting, excreting and excrementitious Humours, with the Natural ones.

The Cause that changes the crude Humours into Digestion, is the remaining Action of Life, the assisting Virtue of the Medicines.

The matter of the Disease thus far digested by its Causes, that the likest may escape to the healthful, is call'd a freeing or removing the Disease: That Action is a resolving or loosning, which makes perfect Health, that happens without any Evacuation; supposing the matter benign, the best Nature and good Medicines.

In acute Diseases, which have their Residence in the Humours, the matter of the Disease is so dispos'd, that the greatest Part in a certain or prefix'd time,

time, makes a sudden change of the Disease, to Health or Death, which thorough change is call'd a *Crisis*, and the very matter thus dispos'd is call'd *critical*.

The Cause of such a Motion, is the remaining Strength of Life, irritated from the matter of the Disease, endowed with various Conditions, that it may be evacuated, transmigrated or be destroy'd.

If the matter is fit for Evacuation or Change of Place, yet not like to that of Health, it produces a different Alteration in the Motion of the Humours from that Condition, which us'd to be in healthful Bodies, it is call'd a critical Perturbation or Disturbance.

But those thorough Changes which arise from the Strength of Life, beginning to move, lead round, mix and separate the critical matter, if they are sensible ones, they are call'd critical Symptoms, and are the Signs of a *Crisis* now coming on, or to be hereafter. The Distinction whereof is difficult, and the Ignorance of it full of Hazard.

For they are often confounded with Symptoms from the Cause of a Disease, from a Disease it self, or the crude matter of the Disease, from whence oftentimes follows an unhappy Method of Cure.

But the Signs by which the critical Symptoms are distinguish'd from the morbid ones, are first of all these. 1st, Those Symptoms are rais'd from the Strength of Life, exceeding the Strength of the Disease, but these from the Strength of the Disease, prevailing over the Vital Faculty. 2^{ly}, Those make their Progress from the Concoction manifested by their Signs, and the Advantage found there, these in the known Crudity. 3^{ly}, Those make a *Crisis* about a proper time, these in every time of the Diseases, especially in the Increase. 4^{ly}, Those are relieved in a short time, these hurt quickly.

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Those Primary Critical Symptoms and Signs, are these which precede an evacuating *Crisis*; after Digestion in a critical time suddenly, without any new apparent Cause of a Disease; a *Stupor*, *Sleepiness*, *Dullness*, *Watching*, *Delirium*, *Anxiety*, a *Dyspnoea*, Pain, Redness, Titillation, Heaviness in the Parts, spontaneous Tears in the Eyes, Loathing, Heat, Thirst, Retraction of the *Hypochondria*, trembling Agitation of the lower Lip.

The Signs of a critical Evacuation are known, if from thence there proceed Vomiting, Salivation, Excretion of *Mucus*, a Flux by Stool, Urine, a Hemorrhage from the Nose, Womb, or Hemorrhoidal Vessels; Sweat, an Abscess, Tumours, Bubo's, Swellings of the Parotids, sore Throat and a Translocation of Humours from Place to Place.

These Things are known to be salubrious *Crisis's*, if they are not disturb'd by Art, but are promoted; if Digestion precedes, the State of the Disease and the Strength of a regular Life, than the Excrements are similar to the Natural one, and agreeable to the Disease and the Part affected, to Diet, Age, Sex and Temperament, the time and place, being assisting after these; as well to the Distemper, as the Symptoms; Colour, Heat, Strength, a Pulse, Respiration, and all the Actions are presently restor'd, begin to recover, and also a Constancy of critical Evacuation even to the end of the Disease, for if there are all these or more Signs, then there will be a perfect Separation from a morbid State to a healthful one, and this is call'd a compleat evacuating or separating *Crisis*.

But if those Signs are wanting, or the contrary of them happen, then it will appear that these are the Symptoms of the Disease, and then they are troublesome, and must be cured as the Disease it self, but if all these are not present, but only some and those not perfect, then it declares the critical matter that

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is brought hither to be amiss, and will produce various *Phænomena*, which *Crisis* is call'd *metastasis*.

From hence, the Axioms in Diagnosticks and Prognosticks and others of the like Nature are received; a critical Evacuation after Concoction is always good.

In the same critical Day it is advantageous.

But it is various according to time and matter, as to the Difference of Age, Constitution, Sex, Climate, Season of the Year, Disease, and Epidemical Temperament.

That will be before Concoction mischievous.

But that Concoction always good.

The quicker the Concoction, the better it is; but not a *Crisis*.

The Fore-knowledge, discovering the Event or Consequence of a Disease, is founded more particularly in the known Causes compar'd amongst themselves, on which depends the Life of the Sick, that is as yet present and remaining, and from whence also the present Disease arises in that; for from these things plainly seen, is found out the *Presage* of the Termination of a Disease in Life, Health, to another Distemper or Death; for from these are understood the Times and Permutation that happen.

The Efficacy of the Cause from which Life as yet remains, is known from some certain Function that remains; first, Vital, then Animal and likewise Natural; which indeed may be pronounc'd from both these Axioms, by which means, the more the Functions are like to those which us'd to be in Health, thence there is a greater Vigour or Life, and that better, and from thence there is more Hopes of a perfect Recovery to Health; for by how much soever that Function is more salubrious in Sickness, from which several others depend as on their Cause, it

it is so much the more serviceable to the Patient, and so on the contrary.

But a Function is known to be like that which is in Health, if the Effects being inseparable and sensible, are found to be such as are there requisite; but first, we must learn from hence the Goodness of it, if the Cause, Matter and Effect of the Disease, are converted by those remaining Functions into Health, and that especially from a good *Digestion* of the morbid Matter and a good Excretion.

The best *Digestion* is thought to be that, whereby the Crudity is soonest and most compleatly made like that of the Natural Humour: From whence this *Axiom*; the better the *Concoction* is made, there is more Hopes for Life and Health.

And it is known, that the Humours return into a sound Condition, and also the solid Parts are restor'd, if certain Actions that are interrupted, during the time of the Crudity are restor'd and made whole again: And if all the Excretions enjoy the Likeness of the sound Parts; from whence these *Axioms* arise, that the more the Actions become salutary, the better the Concoction is; and again, the liker all the Excrements are to the Natural ones, the more perfect is the Concoction; and so on the contrary.

Lastly, The Strength and Force of the Vital Cause is also known from the Age, Sex, Constitution, Life, Country and Family of the Patient. And from all these, the Physician may gather the Strength of the Sick, and the Nature of the Cause.

But the Strength and Magnitude of the Cause producing the Disease is known, first, from its greatest, malignant and most obstinate Causes. 2ly, From the observ'd Disposition of the Disease, by the known epidemical Constitution. 3ly, From the Plenty, Size and Sharpness of the Symptoms. 4ly, From the Crudity or ill Digestion. 5ly, From the great Change of the sensible Qualities, as to Figure, Substance,

Substance, Colour and Consistence. *Ely*, From the Excretions very much receding from Health.

From these Causes exactly known and accurately compar'd among themselves, a Prediction is made by these *Axioms*.

If the Cause of Life be more efficacious in the Sick, than the Cause of the Disease, then the Patient will be cured in a short time.

If the Causes of Life and the Disease be equal in Efficacy, then there is Danger, Continuation, or another Disease foretold.

If the Cause of the Disease be more powerful than the Cause of Life, the Death of the whole, or a Part follows it.

The Greatness of the Danger in Diseases is likewise regarded by the Excess thereof, whereby the Cause of the Disease overcomes the Cause of Life.

The Duration of that is measur'd by its Slowness, from which the Disease tends to its utmost Height, from the Weakness of Life, from the Stubbornness and Toughness of the matter.

Another future Disease is known from thence, when the Strength of the Disease and its Symptoms remit without *Digestion*, and without good, sufficient, critical Evacuation, and that in a Disease from matter.

But that succeeding Disease is often worse than the former, and more lasting, according to the Diversity of the injured Part, which that new Disease takes Possession of, or from the Variableness of the new chang'd morbid matter, or only from the Delay of time.

But the Place may be known, which the ill digested matter of the Disease will possess, from the Itching, Titillation, Redness, Pain, Heat, Swelling, Numbness, Pulsation, Agitation, and continual Uneasiness of the Patient, as well from the Nature

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Nature and Idea, as the universal State of the Disease.

Therefore if it is observ'd, that Art or Accident produces those things in some Part of the Body, as hath been said, then also we may foresee that the matter of the Disease will be collected into that

art. From all these Things it is evident to us, that the Knowledge of *Digestion* and the *Crisis* is particularly to be understood; that good Prognosticks may be made on Diseases; and it is plain, these can only be acquired from the known vital Function, as from its special Cause, and this is chiefly gain'd from the Pulse and Respiration: Therefore it will be proper to enquire into these first, and then of *Urine*, as it is a Recrement from the whole Mass of Blood, and all its Parts, cast out by Vigour and Force of Life, but these require an accurate Consideration.

Of the Pulse, of the Artery, as a Sign.

THE *Pulse* of the Arteries which declares the definite Condition of the Heart as the first Mover, as also the Nature, Plenty and Motion of the universal Fluid, from whence proceed all the rest; together with the different State of the Artery, the primary Vessels of all the Parts of the Body, is manifest in the Art of knowing the *Signs* to confirm the Doctrine of *Pulses*.

Therefore a strong *Pulse* denotes, first, the muscular Force of the contracted Heart, and so the Efficacy of the contracting Cause, that is, 2ly, the sufficiently strong and plentiful Influx of the nervous Humour, and that of the *Cerebellum* into the *Villa* of the Heart. 3ly, Abundance of Blood. 4ly, Circulation and Secretion of the Humours. There-

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fore such a *Pulse* is a good Prognostick, if it is found to be such in the whole Body, and in all the Parts thereof; it frequently deceives in Apoplectick Cases and some others, where the rest are very much obstructed, in their free course from the Heart into the *Cerebellum*, and from that into the Heart, and first of all in the *Viscera*.

A weak *Pulse* shows all things contrary to the former, but sometimes deceives us in those Persons, who are very fat.

A large *Pulse* declares 1st, Plenty of Blood. 2ly, Strength of the Heart. 3ly, A free and contractile Artery. 4ly, A good Circulation and Secretion; a slow *Pulse* signifies the contrary; hence a full and empty one may be understood, as they are truly observ'd.

But a noted hard *Pulse* hath various Significations, as first, that the Membrane of the Artery is dryer than naturally it should be, and therefore, 2ly, there are Obstructions in the minute Vessels, that constitute the Membranes of the Arteries. 3ly, The Arteries are full, but 4ly, obstructed at the Ends of the Capillaries, with an inflammatory Hardness. 5ly, The Blood is very dense and compact, hence 6ly, The Circulations, Secretions and Excretions are interrupted. 7ly, All those numerous little Vessels which follow from these, but a soft *Pulse* shows quite the contrary, yet deceives us especially in an acute *Peripneumonia*.

A *Pulse* that is rare or seldom in a certain stated time, declares 1st, that the Contractions of the Heart are slower, and from thence, 2ly, there is a slower Influx of the *Cerebellous* Fluid thro' the Nerves into the *Villa* of the Heart. 3ly, An equal and assisted Circuit of the Blood. 4ly, An easie Circulation of the Humours thro' all the Vessels. But if such a *Pulse* proceed from Weakness, it is of ill consequence and dangerous, but a more frequent *Pulse*

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denotes the contrary, as irritating Acrids, the Agitation of the Spirits, *Fevers* and *Frenfies*.

A *Pulse* of equal Strength and Frequency is good, and declares the Constancy of Life; the unequal one therefore bad.

The intermitting *Pulse* is pernicious, and denotes the fading Strength and Vigour of Life.

A strong, large, even and slow *Pulse* together, is the best of all, strong and large, strong and slow; large and slow together are good, weak, small, hard, unequal, intermitting and free together, is the worst of all; and always still worse, as more of such like Symptoms meet together.

From the Doctrine of the *Pulses*, we may understand of what Importance Heat is, because it is an Effect of the *Pulse*; for it denotes, that the Vessel is bound or constring'd, the Humour is dense, the Propulsion of the Humours strong, the Resistances are great about the Ends of the Vessels; from whence the Heat being lessen'd shows the contrary; and Heat and Cold are known as to the Diagnostick and Prognostick.

Yet it ought to be remembred, that the Nature of a single Artery, Age, Sex, the Affections of the Mind, the Six Non-naturals, the Habit of the Body, proper Temperament, Climate and Season of the Year, can wonderfully alter all these. But the *Pulse* is accurately to be observed, as it is the Index of the morbid Matter, of Motion, Secretion and Excretion.

Of Respiration, as a Sign.

A N easy Indolent but constant Respiration or Breathing in Diseases, always denotes, that all the Organs contributing thereto are well; that the *Lungs* can easily expand, the Blood readily circulate,

culate, and is therefore fitter to flow thro' all the Vessels of the Body; this is certainly a good Sign; on the contrary, difficulty of breathing is constantly a bad one.

But that Respiration which is also very painful, for the most part declares some internal Inflammation, and is always an ill Sign.

A large Breathing constantly shows, that the Breast is very much dilated of it self, the *Diaphragm* moveable, the *Abdomen* extended, the Blood is easily pass'd thro' the Lungs, and the Strength is good; all which betoken well in Diseases.

A small Respiration signifies the contrary to the former, but especially it shows that the Lungs are very rigid, either with the Blood that will not pass or some other matter; or else that the Pulmonary Pipe is stop't with some Tumour or other Thing, so that the Air can scarcely be receiv'd in; this is a very Bad Sign.

A slow Respiration demonstrates, that the Lungs are equally free and expansible, the Blood enters the Parts, and the *Pulse* is equal: This is a very good Sign, if there is neither *Pain* nor *Delirium*.

A quick Respiration denotes, that the Organs of Breathing are hurt; the Lungs are obstructed, rigid, dry; the Blood not in a Condition to flow thro', and therefore we ought to be under fearful Apprehensions.

An equal Respiration predicts, that the Lungs are good, the Organs right, the Blood well digested, which are good Signs, but uneven, or irregular Breathing, denotes Life is in Danger, and there is an ill Sign.

To take Breath as if a Man was choaking, which creates in the Sick a Sense of Strangling or Suffocation, shows that the Lungs are inflam'd, obstructed, full, rigid and dry; that the Blood does not circulate, whence in a short time it becomes mortal, unless it

be such a one as arises either from a light spasmodick Cause, in Hysterick and Hypochondriack Cases, or from a common one in *Asthma's*.

A Respiration rising on the Top of the Breast, shews the worse Condition of the impleted Lungs, and therefore Danger of Life.

That is most sublime, which is perform'd by the Elevation of the *Clavicles*, the Agitation of the Breast, the Motion of the *Scapula*, the short drawing in of the Sides of the Nostrils, the Inferior Ribs and *Abdomen*, which being work'd strongly together is mortal; for it shows a very difficult Motion of the Blood through the Lungs, and also Want of Strength.

An easy, large, slow, equal, reviving Respiration, perform'd only by the gentle Motion of the *Intercostal Muscles*, those of the *Diaphragm* and *Abdomen*, is extraordinary healthful; but that which supplies the most of these Symptoms, we esteem the best.

A difficult, painful, small, quick, panting, unequal, suffocating high Breathing, exercised with all the Strength of the Muscles growing to the Ribs, is undoubtedly Mortal; but that which hath the most of these ill Symptoms is so much the worse, because it carries the more of them with it.

A cold Breathing is mortal, considering it is always the Fore-runner of a Gangrene of the *Viscera*, and other internal Vessels.

A small Respiration with a whistling Noise and Heat, as it were in the Lungs and Throat, is quickly Mortal, if there remain any more Signs, that are dangerous; it signifies that the Vital Fluid passeth not thro', but is collected there and thrown upon the Lungs.

A large and quick Respiration is often a Sign of Health; and the Cause of a good *Digestion* and *Crisis*.

But one that is large and rare declares the Brain to be obstructed, and the Diseases made from thence present

present or future ; to be a *Coma* or Drowsiness, *Lethargy* and *Delirium*.

In the interim we ought rightly to consider, that Respiration is very disorder'd and different, in different Persons, according to the Nature of the Constitution, the different Formation of the *Breast*, *Lungs*, *Diaphragm*, and *Abdomen* ; the Diversity of Age, Sex, Bulk, Affections of the Mind, Habit of the Body, Climate, Season of the Year, Weather, and the like.

The various Order indeed, by which the received Changes or Alterations of Breathing mutually vary themselves, affords a great deal of Light to the Diagnostick and Prognostick Rules ; for the Change from bad to good is best, but from good to bad the worst ; but at the time the *Crisis* rises, the best.

Therefore because one Respiration declares to us the present State or Condition of the *Heart*, *Lungs*, *Blood*, *Liquor* of the *Cerebellum*, the *Pleura*, *Breast*, *Diaphragm* and *Abdomen* ; it is plain, that an accurate Observation thereof is of the greatest moment, especially in an acute Disease, to prove the Prognostick and confirm the Diagnostick Parr.

Of the Urine, as a Sign.

FROM Sight of the Urine, a Judgment may be made of the Condition of the Body. 1st, The Urine of a sound Man in it self, and comparing it with others, is different according to the Difference of Age, Sex, Temperament, Season of the Year, the Six Non-naturals and Medicines. 2ly, Therefore in passing Judgment of Urine, we are to have nice Regard to other Signs, appearing in Diseases ; or otherwise this Art is very full of Fallacy or Deceit.

In examining the *Urine*, that it may be serviceable to the Physician, to make his Diagnosticks or Prognosticks by, the Quantity, Colour, Smell, Taste, Fluidity, and Contents Inherent therein is consider'd.

The Quantity of Urine increas'd more than usual shows, something of these following either singly or all together: 1st, Abundance of watry Drink. 2ly, The particular Laxness of the Renal Pipes. 3ly, The lessening of Perspiration, Sweat, *Saliva*. 4ly, The taking of Diureticks. 5ly, An imperfect Mixture of Blood, by which the aqueous Part easily departs from the rest. 6ly, Nervous Affections, an Hysterick Temperament, or an Hypochondriack Disease.

Such Urine as this shows the Remainder to be thick. 2ly, The Acrimony of it. 3ly, Thirst. 4ly, Anxieties. 5ly, Obstructions and their Effects. 6ly, A Consumption from a *Diabetes*, which occasions Dryness and burning Heat.

A less Quantity of Urine than usual, signifies 1st, a Sparingness of Drink, or too great Plenty of Spirits, produced from Fermentation. 2ly, The Vessels obstructed or contracted with a *Spasm*. 3ly, An Increase of some other Excretions; but if it is intirely intercepted, it denotes an *Ischury*, and the various Causes thereof.

Such a Secretion of Urine presages, future Repletions, Heaviness, Stupidity, a convulsive Trembling and Apoplexy, especially if it arises from Obstructions.

A thin and as it were watry, limpid, colourless Urine, that is insipid, without Smell, and flows plentifully, shows 1st, that there is abundance of Water or aqueous Liquor drunk. 2ly, That the Renal Vessels are constring'd, while yet the Humours are strongly agitated. 3ly, That there is a close Cohesion of Oil, Salt and Earth in the Urine it self,
like-

likewise a Tenaciousness of these, and difficult Mixture of the watry Part with them. 4ly, Enormous Affections of the Mind, Hypochondriack Insults, Green Sicknes. 5ly, The *Viscera* unapt for Digestion, Crudities, Flegm and Cold. 6ly, Obstructions of the *Viscera* and Vessels. 7ly, But in acute Diseases, it marks out the Impediments of Concoction and a *Crisis*, and the driving of the morbid matter into the inward Parts of the Body.

But in acute and inflammatory Diseases, such Urine foretells the worst Condition of the *Viscera*, *Deliriums*, Frensies, Convulsions and Death, proceeding from a Gangrene, by reason of the retain'd Acrimony.

A red Urine without Sediment in acute Diseases, teaches 1st, a strong Motion of Attrition betwixt the Parts, constituting the Humour, the Vessels and Humours themselves. 2ly, An intimate and tenacious Mixture of Oil, Salt, Earth and Water in the Humours. 3ly, Hence therefore a great Crudity or Indigestion of the Disease. 4ly, A long future Duration of it. 5ly, Great Danger therefrom.

But this Urine presages, 1st, gangrenous Destructions of the minutest Vessels, especially in the Brain and *Cerebellum*, and from thence Death. 2ly, A difficult Digestion. 3ly, A slow *Crisis*, and that very ambiguous; but all these appear the worse, the redder the Urine is, and also the more without Sediment.

Hence a thin Flame colour'd Urine without any Sediment, shows the same thing, but more violent, from whence comes the same Prognostick, but much more dangerous.

A red Urine together with a copious Sediment, that is heavy, looks red on the sides of the Vessel, and is like Bole, shows that the foregoing Motion of Nutrition was vehement. 2ly, The Vessels lax

3ly, The Blood, Acrid, Saline, and unfit for Nourishment. 4ly, Intermitting Fevers, that have had strong Paroxysms. 5ly, Scurvy, in these Northern Parts.

It presages 1st, the Length of the Disease. 2ly, The Attrition, Weakness and Destruction of the Vessels. 3ly, Sweats, Urine, Saliva, *Diarrhæa's*, Colliquative Sweats. 4ly, An *Atrophy*. 5ly, Some Sort of Dropsies.

If in such Urine, the Sediment is branny or rough, it denotes the same indeed but much worse.

But if the Urine is of a Saffron Colour, that will strike a Tincture or Colour in the Glass, and have such a Sediment as the last mentioned; it betokens the yellow Jaundice, and the Symptoms are certain and evident in the Skin, the Stools, *Hypochondria*, and throughout the Body, from whence clear Prognosticks are derived, from the History of that Disease.

A green colour'd Urine together with a gross Sediment, signifies 1st, that the Temperament is atrabilious. 2ly, That the soluted matter thereof is excreted. And therefore, there are Oppressions about the Heart, Costiveness of the Excrement, Iliack and Cholick Pains.

Such Urine foretells, that the atrabilious matter being dissolved and moved, passes into the Blood and *Viscera*; from whence are infinite and acute Diseases, which may be traced from the History of this Disposition, of the melancholy or black Bile; and also from these Things we know, what we are to think of black Urine, that is of much worse Tendency.

Blood, Pus, Caruncles, Filaments, Shreads Hairs, grumous Slime, Gravel, Parts of Stones, a *Mucus* in the bottom of the Urine, set forth the Vices of the Kidneys, Ureters, Bladder, Testes, Seminal Vesicles, Prostate, Cowper's Glands and Urethra.

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But what the Nature of the Evil is, that is shown by the said Symptoms, and what Place or Part is affected, the concurring Signs ought to teach us, that are observ'd in that Disease, where the said Things are produced.

Fat appearing in the *Urine*, often brings with it small Sands or Gravel envelop'd in the viscid part, and create a kind of oily Membrane, which denotes a great deal of Earth and stuggish Salt in the Blood, which foretells the *Scurvy*, Stones and the like.

But *Urine* that is very fat and oily, certainly very rare if ever observ'd, shows, first, That the Vessels are ground in pieces by too great Motion, hence dissolved, mixed with the Blood and excreted with the Urine. 2ly, Acrid Humours, and therefore it will threaten a *Phthisick* and an *Atrophy*.

Urine, that being shak'd holds the Froth long upon it, denotes that the Oils and Salts are mix'd and dissolv'd into a soapy *Lixivium*, and therefore shows, first, The Tenaciousness of the Mixture. 2ly, The Difficulty of the Digestion and *Crisis*. 3ly, The Diseases are almost pulmonick and catarrhus in the Head.

An *Urine* that is naturally fetid, shows, the Salts and Oils are attenuated, dissolv'd and almost putrefied, hence arises the greatest Distinction, as well in chronick as acute Cases, and the Cure not easy to be effected.

Urine that appears colour'd, but yet hath no Taste or Savour, confirms the broken Strength of Nature and the Approach of Death.

A pale thin *Urine*, with a mucous slimy Sediment and putrid Saltness, is almost always a Mark of the Stone in the Bladder.

In *Fevers* that are acute, the *Urine* is first to be consulted, as being a sufficient sure Prognostick: For first, The *Urine* that hath a white, light, smooth even Sediment, that is muddy, quick, subsides and scarcely

scarcely smells at all in the whole Course of the Disease to the very *Crisis*, is the best Indication and Fore-runner. 2ly, Much white strangurious Urine, with a plentiful Sediment that is white and discharg'd at a critical time, heals and takes away the Abscess. 3ly, A large quantity of Urine in the critical Day, with a white or reddish Sediment that is plentiful and light, denotes in the critical Day a Cure from a perfect *Crisis*. 4ly, A thin and reddish Urine that subsides not, a white, thin and watry one, a yellow thin Urine that is not muddy, or a muddy one that remains so and breaks not, show that the Digestion is very much impeded in acute Diseases, there is a great Crudity, a difficult *Crisis*, the Disease will be long and there is the utmost Danger of Life; but in acute inflammatory Cases, it portends almost certain Death; lastly, in moderate acute ones, it betokens a long and tedious Disease; from whence perhaps a various Abscess or a *Metastasis* of the Disease.

Therefore the Urine declares to us first, the Nature, Force and Symptoms of the Blood. 2ly, The State of the Disease and of Digestion. 3ly, The Condition of Secretion and a *Crisis*. 4ly, The Diseases of the *Kidneys, Ureters, Bladder, Testes, Vasa deferentia, seminal Vesicles, Prostata, &c.* 5ly, Some Complaints arising in the Bile, the rest that are taken from Urine alone, are all uncertain and very ridiculous.

T R I E N H,

Or the Hygieneal Part of Physick.

THERE are Three Offices or Duties of the Art of maintaining Health in its sound State or Condition; to wit, to preserve Health that is present,

sent, to prevent Diseases that lurk in the Temperament of the Body as a Seed, and that is easily rais'd from thence; and lastly to dispose Life so as to last or endure to Old Age.

For Health, since it is an Aptitude or Fitness of the Body to exercise certain Actions, and since this consists in a determinate Motion of the Parts, as well Solids as Fluids, it is necessary, that this very thing I call *Health*, if it is once made perfect, shou'd from its own Nature wear away the solid Parts, consume the Fluids, break both and consequently destroy its very self.

Hence *Health* is preserved by constantly restoring the same quantity and quality of all the Parts in the Body, such as they were before the described Destruction in the solid and fluid Parts.

To this Restitution, Meat and Drink and perhaps Air affords some Matter, hence they prepare and adapt the Aliment in the Body by vital, natural and animal Actions; they apply what is prepared, to requisite and proper Places; and lastly, by these it is freed from superfluous undigested and hurtful things.

Wherefore it is plain, that this whole Art of maintaining Health, being placed in the Description of Laws or Rules, which describe their definite Use; yet it is difficult to promulgate these Laws, that the Observation of them may equally profit every Man.

The Cause of which Difficulty as it chiefly lodges in the *Idiosyncrasy*, therefore it often performs contrary Effects in Men, who yet follow the same way or method of Living; so that perfect Health may be kept by every one, altho' they use not only different but quite opposite ways of Living, than what is prescrib'd in the Use of the Six Non-naturals; when on the contrary, shou'd they change their way of Living, tho' for the better, they wou'd run into a sickly or unhealthful State.

Also

Also *Custom* it self, which they do not call amiss a second Nature or *Idiosyncrasy*, produces what is scarcely to be believed, if we consider the Effects of the Air, Meat, Drink, Motion, Medicine, Poison, &c.

Wherefore a sudden Change from things accustomed, into Novelties, is always and in all places very dangerous, tho' we shou'd alter from ill Customs to such as were reckon'd good ones.

But gradual changing, and frequently to vary the daily Course of Life, is of vast Service to the Maintenance and Support of Health.

The Air that is always heavy, but yet serene and dry, is esteem'd salubrious in every Place : The Effects of it are various, being favourable or hurtful in its Nature, when we inquire into the secret Causes of Health.

The Qualities of the Air, from their Excess producing Diseases, may be remedied by opposite Inductions ; for the cold and moist may be chang'd into hot and dry by the Help of Fire, by dry aromatick Woods, by the Fumes or Smoke of fragrant Fuel, by the admision of warm Air, procured by Art, but if the Air is offensive by Heat and Dryness, it is rectified by the Exhalation of refrigerating things, after an artificial manner, or from the drawing up of watry Vapours from cold Plants, as the *Sallow*, *Popular*, *Rose*, *Elder*, *Mulberry*, &c.

Therefore a serene heavy Air, temperately hot and dry, breath'd in from Inland Parts and fresh Rivers, agitated by a gentle Wind, not liable to sudden and great Changes, but open and expos'd to the Sun Beams, being free from saline and oily Exhalations, is the best in general for Preservation of Health.

But that Diet is esteem'd the best, which is the most simple and least feculent, void of all Acrimony, and

and scarce endowed with any great Motion of Parts, most like to the healthful Temperament of the Body, or at least most easily assimilated to it by the Assistance of *Digestion*, and is prepared to be capable of performing the foresaid Offices by the culinary Art; this is call'd *Kitchen Physick*.

Such as every thing that is chose, first, From Grain, as Corn and Flower that is clean and moderately dry, yet fresh or new, as Wheat, Rye, Barley, Oats, Rice, &c. which by Grinding, Sifting, Fermentation and Boiling or Baking, is so prepared, that from its grateful Taste and Smell it is recommended under the Name of Bread, &c. 2ly, From Leguminous Fruits, as well Seeds as the like, as Pea's, Beans, Lentils, Vetch's, &c. which are prepared as the former, or else by bruising, pounding and boiling. 3ly, From fresh green olerant Herbs, by gathering their tender young Leaves, &c. as Lettice, Spinage, Succory, Purslane, Sallery, Parsley, Sprouts, Beets, which are prepared by stewing them in their own Juice by gentle boiling. 4ly, From Fruits whether more solid as Nuts, Almonds, the Bulbs of Turnips, Potatoes, Artichokes, or from Roots of Carrots, Parsnips, Radish, Beet and the like, or from the softer kind, as Apples, Pears, Berries, Plums, Cherries. 5ly, From the Juice and Substance or Flesh of a young sound Animal, whether it be Quadruped, Bird or Fish, either Insects or Testaceous, if they be prepared by Broiling, Frying, Roasting, Boiling or Baking, to which also we refer Eggs and Milk.

Hard, dry, gross, ponderous feculent Food, are proper for such who want the *Viscera* to be strengthen'd, the *Digestion* quicken'd, the muscular Motion greater, and the Humours more agile in Health; but the soft, moist, thin, light and pure Aliment is opposite to those, and always fit to supply the Table.

But

But those Persons whose *Viscera* are weak, Digestion difficult, and who enjoy a quiet, sedentary idle Life, ought to have such Food as is made by Art or Nature most like to the diluted *Chyle*.

In an alcalifate Temperament, such things as are sharp and sour agree, in an acid or sour one Alkalies are profitable.

From which few things, the whole reason of our Choice of the Quantity and Preparation of Aliment depends; if we first know the Use of the *Viscera*, the Humours, Constitution, Age, Sex and Manner of living.

The best Quantity of Meat or Diet to every one is, that he only pursue the Refreshment of his Appetite, not the Dulling or Clogging of it: Sobriety is safest to the weak, Excess better to the strong.

Sauces or Pickles from Acids, salt and aromatick Spices, do Injury to the healthful by their noxious Acrimony, which wound the finer Vessels, and by a false Appetite rais'd by stimulating the Parts, they load the Body rather than nourish it.

The Goodness or Usefulness of Drink is to be understood from the same Rules, for if it is required to quench Thirst or remove a Dryness and a Thickness of the Humours, and to qualify the Acrimony thereof; then cold, clear, light, running Water from pure Springs or Rivers, is the best.

But if Drink is required, to the Intention that it may warm and stimulate to Motion, and attenuate the Humours, then well brewed Malt Liquors that are kept till they are fine, are proper, as also sprightly neat Wines that are fragrant and grateful; but the Choice, Quantity and Use of them must be determined by the State and Condition of the Person that drinks them.

Meats that are the least fat, and the drinking of Water renders the Body firmest and strongest.

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The Prophylactick or Preventing Part of Physick. 287

The Motion of the Body from the Beginning to the End of a gentle Sweat, or even to the Perception of the approaching Weariness after Digestion is begun, with a Sense of Lightness, is best; from whence the regular Method of Rest is taken.

The time of Sleep, when the Body sleeps sound, is best measured by the Agility and Briskness of the Body when awake.

All Medicines, either evacuator or acrid, by whatsoever Title distinguish'd, are always to be avoided.

The Purgations or Cleansings of the outward Skin by Frictions, Lotions, Baths, Fomentations, Swimming and Deterfions are of excellent Use.

But the Affections of the Mind or Passions are not altogether to be suppress'd, neither too much excited or stir'd up, for it raises a Stupidity or turns the Circulation: Hope and Desire are found to be salutary to the Body.

Π Ρ Ο Φ Υ Λ Α Α Ε Ι Σ.

The Prophylactick or Preventing Part of Physick.

Diseases are prevented, when at the same time the first Signs of their future Approach are discover'd, and you presently have recourse to their Causes.

But the primary Prophylactick Remedies of Diseases rising suddenly, are indeed these; Abstinence, Rest, warm Liquors, then gentle and sometimes constant Motion, till a breathing Sweat is rais'd, afterwards a large Sleep or Rest with the Body being well cover'd; by this means the gross or thicker Fluids are diluted, the Vessels relaxed, and the noxious Humours excerned.

Neither

Neither is there any thing else, that defends the Body better against the Force of external Causes, than if any one in Spring time casts off his Winter Cloaths by degrees, and again increases his Summer Wearing early in the Autumn Season.

We ought also to moderate our Diet at certain times, which may be done by these few simple Rules: In *Summer*, a light, soft, loosening, moist Diet is proper, of olerant Herbs, Fruits, Milk, Broths, with plenty of aqueous or diluting Liquors, and with gentle Exercise of the Body avoiding all that is violent.

In *Winter*, a solid dry Diet is best, that is acrid with Spice and Salt, roasted Meat, Bread more baked, with a sparing quantity of pure unmix'd Wine, and a more vigorous Exercise of the Body.

In *Spring* and *Autumn*, your Diet is to be moderated in a middle Temperament betwixt *Summer* and *Winter*; considering likewise into which of these Seasons you more or less incline.

Diet to prolong Life.

A Thorough sound Body, by Actions that are inseparable from a healthful Condition of Life, by degrees is so chang'd, that the smallest Fibres become rigid or stiff, but the finest Vessels grow into concreted Fibres, not pervious to the Humours, the larger Vessels harden and close, but they are all drawn together, growing each to the other, from whence comes Dryness, want of Motion, and a Decay of Age: Here the Offices of the little Vessels are destroy'd, the Humours stagnate in them, move slowly and coalesce among themselves, and with their proper Canals dwindle away; Digestion is weaken'd, Reparation wanting, the gross Humours run slowly, only thro' the larger Vessels, and maintain

Diet to prolong Life.

tain Life singly without its Animal Actions; from whence at last, Death in Old Age becomes inevitable thro' these Changes, and flows even from Health it self.

Therefore this sooner happens, if the Actions of a healthful State and Condition have been more violent, but later if they have been moderate: And in the Moderation here of a just Mediocrity, Old Age seems to be promis'd as possible to be attain'd by Art, especially if the *Hygieneal* and *Prophylactick* Part conspire so by their Effects, that they do not interrupt or molest this Design; almost all the rest return hither, if they have been gather'd together.

All these Conditions ought to be join'd to the Body, as much as that can be gain'd by any Art: The Actions of the Body being thus instituted, that the Reparation of what is lost or expended, the Assimilation of what is taken in by the Mouth, as Meat and Drink, the Term of a requisite Encrease, the Expulsion of the *Fæces*, are easily, gently, and constantly made, from whence moderate constant Labour is serviceable upon a slight Lassitude or Weariness, being more gentle in Childhood, increasing by degrees with the Strength of the Body, and decreasing continually in Old Age.

Those Operations or Workings of the Mind, are to be chose which are most agreeable to every Man's particular *Genius* or Inclination, but these are to be directed, that by preserving a Moderation, the Spirits may not be stupified or numb'd with Rest, or dissipated and wasted by too much Motion; in Youth sharp Contention shou'd be forbid to be exercised except by degrees, and which sensibly increasing in Age, is more to be moderated.

Simple Food that is dry, hard, tenacious and difficult to Putrefaction, but not acrid; *Vegetables*, as Bread, Roots and austere Fruits; lean salted Meat of *Animals*, or Fish prepared after the same manner,

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have been approved. In Childhood, Milk, by degrees Bread, then more solid Food is administred, whereby Age grows to be more strong, and at length returns by degrees to the Diet of Children again.

A sparing Draught of good cold Water, serving only to dilute and quench Thirst, is commended for the greatest Example of producing these Effects: Ripe, fine, soft Malt Liquor and Wine may be admitted with moderate Use, but too much is hurtful. In Youth, Milk, by degrees things more diluting, then Water in the Vigour of Age, but in Old Age a little soft Wine may be admitted.

In the interim, the greatest Abstinence, the most accurate lean Diet, rarely or now and then interpos'd, are of wonderful Use.

When Age increases, the Introduction of Nutrient, by applying Externals, is made from Vapours or Fumes, Fomentations, Baths, Clysters, Unguents, &c.

A pure, campaign, mountainous open Air, as well as a shady one in Woods, and that more cool in Islands, is commended before all others.

The Excretion of gross Humours about Old Age, is to be assisted with greatest Safety by those things which most excite the Fibres, and loosen the *Fæces*; where Saffron, Salt, and Aromaticks are mix'd with Honey and good Wine.

The Changes of the Humours that are almost radical by Resolvents, from thence the succeeding Excretions of them, as the received Cures by the virtue of Quick-silver, or by attenuating, drying, sudorific Diet Drinks, often dispose the Body to a ready Expulsion of the old and the Restoration of a new vital matter, from whence prudent Art by this means conducts us to long Life.

Vapours, Fomentations, Unguents, Baths, Clysters, from sweet Odours, from Milk, Broth, Oil, living

The Therapeutick or Methodical Part, &c.
living Animals, that are egregious Remedies for aged Dryness, Checks to Death and Helps to long Life, are yet injurious to Youth.

But yet from what hath been said, it is plain, that those things which render the Body large, hard, constant and fit to bear Age, and keep off the strongest Diseases, and especially the Sharpness of the most sprightly Wit from being dull'd and impeded in the ruder Organs are not the Causes of gaining perfect Health, or Helps to procure long Life.

But the vaineſt Boastings, without any Foundation in reason, or Faith of Experiments, are those firm Promises which are recommended to this end; to wit, the Use of *Helmont's* first *Eus*, the *Elixir Proprietatis* of *Paracelsus*, the fam'd Tincture of the *Adepts*, the first *Eus* of Metals, Fossils, Animals, Vegetables, the repeated Purges by the Leaves of black *Hellebore*, Spirit of *Sulphur* by the Bell, Spirit of Flowers of *Rosemary*, the attractive Virtue of a Spirit drawn from the Body of a sound young Man, of long-liv'd Animals, &c. for renewing the Parts, as also Sigils of Planets producing Life.

Neither is it very likely, that we can by the best method protract Life to numberless Years, as the Chymical Adepts wou'd make us believe; nay, all these things are confuted by their own Experiments.

Θ Ε Ρ Α Π Ε Υ Τ Ι Κ Η'.

The Therapeutick or Methodical Part of Healing.

THis last Part of the Institutions of Physick teaches us general Precepts, which set forth how a Physician in the Cure of the Sick may acquit himself of these Four Duties; First, to preserve Life, 2ly, to take away the Causes of a Disease,

2ly, to remove the Disease it self, and 4ly, to expel or drive away the present Effects of the Disease.

That these Four may be perform'd, the Body of the Patient ought to be chang'd ; wherefore there are Instruments required, from the Efficacy of applying which, the necessary Alterations are made ; and these are call'd Helps, Remedies, Succours or Medicines.

But these Remedies are apply'd to every particular Patient so, that there may be made a necessary Change in him ; wherefore the Physician ought to know first of all, what ought to be chang'd in him, and then by what Assistance he is to do this ; and therefore he ought to know the Effects which will follow from these Applications on the Patient ; both which can only be learnt from those things which are known to him in the sick Person by his Senses, or by accurate reasoning, that from thence he may behold the Action sought for, and the Remedies for it.

That very thing, whatever it is, that is thus discovered, so instructs the Mind of the Physician, that it is called *Indicans*, disclosing or detecting a thing ; but the Intellect of the thing known rais'd in the Physician, is call'd an *Indication* ; and that which is known to be done, is call'd *Indicated*.

The indicating matter may be all that which is known in the sick or about him, present, past or to come, so that it produces this Knowledge wherefore it is found manifold.

Yet all that may be assign'd, first, To Life remaining in the sick Person, the Causes thereof, its Nature, Consequences and Degrees. 2ly, To the Disease present in that, its Causes, Nature, Consequences and Symptoms.

For from all these the Physician learns, first, What is to be done that he may preserve the present Life ;
that

The Method of Healing.

that he may recruit or restore what is lost; and that those things may be removed which destroy Life, or is able to lessen and abate it. *ly*, What Instruments are to be chose for this Work, how they ought to be adapted and apply'd in certain Order and Time.

Lastly, That Part of Therapeuticks which sets forth Rules, by the Demonstration of which, the things *indicating* and *indicated* may be detected, is the *Method of Healing*, of which here follows a short *Compendium*.

The Method of Healing.

Life continuing in every Patient, also the Cause and Effect thereof remaining; these things are call'd natural, according to the Laws of Nature, and oftentimes Nature it self.

But since Life always acts, there will be in the Sick some Actions exceeding which at first accompanied Health, and therefore may be judg'd the Remains of former Health and the Effects of Life present, which may pass under the Name of Strength.

Which being rightly examined, are found to depend on the Motion of the Humours abounding thro' the Vessels, whatsoever that Motion hath been.

But that reduced to the least things possible, at least pushes on the Motion of the Humours circularly thro' the Heart, Lungs and *Cerebellum*; in which consists the minutest Strength of Life, which also from hence may be augmented in various degrees.

This evidently appears shou'd be known and discover'd by the Physician, towards the Preservation

of the Sick, and restoring him to perfect Health ; which Knowledge also is call'd a vital or conservatory *Indication*.

The Cause of a Disease being known, indicates the Correction or Removal thereof : The first Cause is judg'd from its Effect, and therefore this *Indication* is call'd *Prognostick* or *Preservatory*, as giving a turn to an approaching Disease, by eradicating or taking away the Cause.

But a present visible Disease indicates, that it should be removed ; which *Indication* is call'd *Curative* or *Therapeutick*.

Lastly, the known Symptoms, if they are so dangerous and troublesome, that the Cure of 'em cannot be differ'd, till the Disease on which they depend can be healed, they *indicate* a Mitigation and particular Cure ; and this *Indication* is call'd an urgent, necessary or palliative Cure.

From whence now it is evident, we cannot *indicate* how to act and do right, unless we know first of all what Life is, the Cause, State, Strength and Effects thereof ; and also from the Survey of a Disease, its Cause, Condition, Strength and Effects.

Then likewise must be indicated what is to be done, and from thence by what means, with what Dose, in what Condition, Time and Order.

But since all these Particulars are in one and the same Patient, so that every Particular indicates what is singularly to be done, and also they show the singular Helps that are to be apply'd ; it often happens that one of these indicate some other thing than the Rest, and sometimes requires that something contrary shou'd be done, or some Remedy given that is quite opposite to what was required by another *Indication*. Therefore this is an useful and celebrated Doctrine of *indicating*, *contra-indicating*, *repugnant*, *permittent*, *co-incident*, &c. which may be easily understood from what hath been said.

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Therefore when it happens that Contraries meet together, the Physician's best way is to have recourse to medicinal Axioms, which determine him what he is to do or choose from doubtful things, therefore they remove this otherwise seeming Difficulty, after this manner.

1. Whatever is indicated in the Sick, that requires Conservation or Ablation.

2. Whatever is found according to Nature, that is always to be preserv'd.

3. Whatever is discovered contrary to Nature, that is to be taken away.

4. It consists of those things with which the Body is nourish'd.

5. Like things are to be preserv'd to like.

6. The Cause curing by Medicines is Life exceeding the Disease; and a *Temperament* proper to every one, without which, Medicine is a sluggish and unactive Nothing.

7. Therefore where a *vital Indication* offers, and also what attends it, there will always be what will satisfy the first.

8. But where an unequal *Indication* urges likewise, then it will be always enough to satisfy the greatest.

9. Those things that do good and harm, are particular *Indications*.

10. Contraries are removed by contraries.

11. Nature is pleas'd with things accustom'd to, and bears the contrary with great Uneasiness.

12. In the greatest or strongest Diseases, the strongest or most efficacious Remedies are to be tryed, and that speedily.

13. In milder Diseases, the most gentle Medicines are to be given leisurely and often.

A Vital Indication.

THE Condition of Life is known from regarding the Strength thereof.

These are discover'd by the Effects of it exercis'd in the sick Body.

Which are the surviving Use of the Functions as yet remaining.

But these are the Propulsion of the Humours thro' the Vessels and the *Viscera*.

In which there is required a due quantity of apt Humour, and a continued Action of this thro' the Vessels themselves.

The Action of the Vessels alone depends on that Contraction of the Fibres, by which these being drawn aside from the transluent Humour, and distended arch-wise shorten themselves, being dispos'd into right lines, they approach towards the *Axis* of its Cavity, and propel the Humour contain'd in them; therefore these are properly the Strength of the Vessels variously determin'd according to the Figure of them.

But it appears that these require the elastick and contractile Force of the Fibre, which is resisted or oppos'd by its Separation.

And likewise they expel by the vasculous Membranes of the larger Vessels, and Influx of subtil Humour moved into the smallest nervous Vessels, and others alternately, according to the Pulsation of the grosser Humours by the largest Vessels.

Cardiacks and Diet for the Sick.

BUT since the *Heart* is the principal Cause of all those Motions on which the vital *Stamina* depend, hence those Helps or Assistances which do good

good and bring Relief to the vital Indication, are with some justice call'd *Cardiacks*, tho' they do not immediately relieve the Heart alone.

We shall find these to be various, but yet they may and ought to be reduced to certain *Classes*, to wit, first, some of them restore a due quantity of sound Juices in the Body: 2ly, Others give a vigorous Strength to the Tone of the Fibres, and procure to them a requisite Elasticity. 3ly, And some of them increase the Quantity and Motion of the nervous Juice, that from the replete minute Vessels, the larger may be strengthen'd and confirm'd. Lastly, They stimulate the moving Fibres, and so move the unactive Vessels and sluggish stagnating Humours.

To the first Class of these I refer the Liquors that are first, endowed with a Faculty of nourishing the Body of the Sick. And 2ly, those that are so prepared before-hand, that they shall not stand in need of chewing or Digestion, either in the Stomach or Intestines, which is wanting in the weak and exhausted *Patient*, or at least operates too slowly. 3ly, They consist of such a matter, which does not easily corrupt or putresce of its own accord, when it wants sufficient Strength to expell it quickly, because the Actions of the *Viscera* are weak at this time, or while something of a morbid and corrupt Humour is mix'd with the Aliment in the Body. 4ly, And lastly, that they be not of such a Nature, as is similar to the morbid Humours in the sick Body, and which feeds and increases the Malignity and the Cause of the Disease, and produces the *Symptoms* thereof.

Such *Cardiacks* are indicated to be administred to the Want of Strength, together with the Signs of the Emptiness of the Vessels.

But the particular matter of them is requisite to be understood, if the Physician would know accurately

rately the proper Disposition of the vitious Humour, which offends by being predominant in the Sick; for then we are to make choice of such Cardiaack Materials, as are opposite or contrary to that detected Vice, but this Doctrine is to be met withal in the *Semneotical Part* of Medicine.

Therefore where the Humours incline to an *Alcaline* Nature, then the Cardiaack Materials are best found, in a thorough Decoction of frumentaceous Grain and Seeds, prepared with the purest Waters well boil'd, that from thence may be made *Prisans*, *Panada's Flummery*, &c. the last of which is most recommended for Use: All these frumentaceous and leguminous Preparations are of greatest Service for the Diet of the Sick, together with *Emulsions* and *Decoctions* of Almonds, Rice, *Pistachia Nurs*, Poppy Seeds, &c. 2ly, Of mature, grateful, sharp or sweet Fruits, especially the succulent kind, or such as are preserv'd with Sugar, or converted into Jellies; as tart vinous Apples, ripe Quinces, Oranges of all kinds, Pears, Peaches, Nectarines, Apricocks, Prunes, Plums, Cherries, Mulberries, Raspberries, Currans, Strawberries, &c. 3ldy, From pulpy, soft Fruits, eaten raw, or pickled, as Cucumbers, Gourds, Melons and Artichocks. 4ly, From milky olerant Herbs, as red Cabbage, Succory, Purslane, Sorrel, &c. 5ly, The Milk of Animals during the Summer Pasturage, with the Whey, Cream and Butter-milk.

The Choice, Preparation, Quantity, Occasion and Order of administering all which are indicated from the Age, Sex, Constitution, Custom, Diet, Cause and Disease of the Patient, together with the Continuance and *Symptoms* thereof, the Season of the Year, Temperature of the Weather, and the like are to be consider'd.

But if there be an acid Disposition found to predominate, then these *Cardiacks* are to be met with in the animal Kingdom, whose firmer Parts are to be

be render'd apter for Nutrition by boiling in Water, to Broths, Jellies, &c. to this Head also, Eggs and those Things which arise from a various Composition of different Parts are to be refer'd; in the Use of which, all those things are to be observ'd, which have been before hinted.

If a muriatick Acrimony abound, those Things are convenient, which are describ'd under the first Head of Diet, to wit, Corn, Fruits, Seeds, Herbs, &c. that are devoid of Salt and Vinegar; so likewise where the acrid, oleous matter offends.

To the next Class of *Cardiacks*, those things are thought to pertain, which first, being applying to the flaccid Fibrils of the Vessels, and adhering to them, render them more rigid, such as are all these in which a moderate astringent Virtue is commended, as Apples and Pears that are austere, Quinces, Pomegranates; Fruits that are gently-eager or tart, Horns, Shrubs, &c. as all the kinds of Myrobalans, Acorns, Barberies, Myrtle-berries, Acacia, Roses, Services; Herbs as Cinquefoil, Tormentil, Burdock, Plantane, Purslane, Pimpernel, Bistort, &c. Flowers of Pomegranate, Roses; the Pomegranate Rind, Peruvian and Tamarisk Bark; Roots of Capers, Myrobalans, Juice of Acacia, and Sloes, Mallick, Frankincense, Dragons Blood, Gum Lac, austere Wines, &c. Earths or Metallick Bodies, as Bole, Chalk, Lemnian and Japan Earth, Allum, Vitriol and Iron or Steel. 2ly, Those things which joyn together the resolved or broken Fibres of the Body, so as to make them one compact Substance one with the other; such as are all the forementioned, and especially those which are found to be very binding, as the austere Vegetables and Fossils, unripe Fruits, calcined Vitriols, calcined Bones, &c.

Such things are indicated to be necessary, when there is a great Weakness throughout the whole

whole Body, together with Paleness, Coldness, Stupidity, a serous Stench, and a remarkable Weakness of the Body.

But in administering these things a prudent Caution is to be observed, especially upon the Consideration of Experience, from whence we know that austere things acting too much upon the first Passages, make it difficult for them to be convey'd into the internal Parts.

But the third Class of *Cardiacks* seems to consist chiefly in the most subtil and fine Part of sound, young, vigorous Animals, plentifully convey'd into the weak Body to supply the defects thereof, this appears to be done, first, From expiring Exhalations that arise from those Bodies, while they are apply'd to the sick Body, like that of Fomentation. 2ly, By sucking Milk from the Breasts of any Creature. 3ly, By taking the Gravy stewed from the Flesh of an Animal. 4ly, By odorous soft Vapours of Saffron, Jasmine, Citron, Orange Balm, &c. 5ly, By fragrant sweet scented Wines, sufficiently volatile and brisk.

These *Cardiacks* are known to be necessary, when the Strength of the Body is known to fail, and also there appears evident Signs of Languidness thro' all the muscular Motions, and likewise the Exercise or Use of the Senses is much impeded, but especially if there then appear evident Signs, the Humours being gross and thicken'd in all the Vessels.

The last Class of *Cardiacks* will be found to be very large and numerous, and therefore ought to be subdivided to render them more easily understood. First, then they are the fresh Juices of all those Fruits, in which there is a grateful, sharp, penetrating, refreshing Taste, any sweet fragrant Smell, and also any Power of affording Nourishment: The first of these are Oranges both sweet and sour, ripe Pomegranates, fragrant Apples, *Ananas*, or the King of Fruits;

Fruits; Melons, Cherries, Strawberries, Mulberries, Raspberries, Currans, black Cherries, Prunes, Peaches and Nectarines, and many others of the like Nature, which are the best stimulating Medicines in hot and dry Weakness. 2ly, The diffusive Odours of the most fragrant Vegetables, as Orange Citron and Limon Peel; Flowers of Borage, Betony, Bugloss, Saffron, Jasmine, Lilly of the Vally, Galbanum, Balm, Myrtle, Sassafras, Hyacinth, Rhodium, &c. or the more acrid and hotter kind, as Southernwood, Wormwood, Amomum, Dill, Angelica, Annise, Mugwort, Cyprus, Calamint, Cummin, Coriander, Cloves, Cinamon, Cardamoms, Dictamny, Galin-gal, Hyssop, Masterwort, Juniper, Lavender, Bays, Mace, Mint, Majoram, Marum, Mastick, Nutmegs, Penny-royal, Rue, Savine, Sage, Thyme, Ginger, &c. to which may be added the Gums of Ammoniacum, Bdellium, Elemi, Galbanum, Myrrhe Opopanax, Sagapenum, Asa fætida, Camphore, Storax and liquid Ambar. 3ly, Particular Odours that produce singular and wonderful Effects on many, as are found in Ambergreece, Benjamin, Castor, Musk, Storax, and Civet. 4ly, From all these together, received and acting in the Body. 5ly, Here is a numerous Series of those things which strangely affect the Nerves, being endowed with a volatile, thin, acrid, stimulating Force or Virtue; and may be reduced, first, To Acids, as are Wines and Vinegars, as well simple as aromack. 2ly, To things call'd spirituous, as are all simple, vegetable Spirits, prepared by Fermentation, or replete with the Odours of Aromatics. 3ly, Simple, Volatile, Alcaline Spirits, or united to Spirit of Wine and aromack Oils. 4ly, Distill'd, Aromack Oils, or those by Expression. 5ly, Compounded ones of which there are without Number, according to the Pleasure of the Maker; from which Epithemums, Liniments and Medicinal Drinks are made, to these we may also reckon

reckon simple and compound, distill'd, aromatick Waters, and odorous, artificial Balsams, simple and compounded Cardiack Confections, aromatick, oleous Spirits, volatile, oily Salts, aromatick and spirituous of various kinds; Tinctures prepared with Spirit of Wine, from the most fragrant Aromaticks, and many others according to every Man's particular Inclination.

In the use of all these, there is need of great Caution, for being administred to the Body, where the Humours lodge in the Vessels, not dispos'd to an easie Transmission of the Fluids, they excite a Motion which tends to sudden Destruction: There we must have regard again, to all the Cautions laid down.

This kind of Cardiacks is indicated from the want of a circular Motion of the Fluids, which Deficiency arises, from the Unactiveness only of the Fibres, together with the gentle Humours and Vessels apt for Transmission; but what single *Species* is to be chose, we are taught from considering the Nature and Disposition of the Disease, and the Cardiack to be administred. But now having done with the Diet of the Sick, we shall proceed to the Cure of a Disease.

ΠΡΟΦΥΛΑΞΙΣ ΘΕΡΑΠΕΥΤΙΚΗ,

Or the Therapeutical Prophylaxis.

THE Causes of the Diseases being accurately known by their Signs, Indicate the Ablation or Removal thereof, therefore if they are consider'd to lodge in the firm or solid Parts they require, first, the taking away the destructive or injurious external Cause, or 2ly, the Union of the Parts morbidly separated, or 3ly, the Separation of the Parts morbidly

morbidly united, or 4ly, the Removal of the Superfluous, or lastly, a Supply of what is wanting.

These *Indications* occurring or meeting together in the larger and more sensible Parts, require the Assistance of *Chirurgery*, which is wholly imploy'd, that by its Operations artfully perform'd by the Hand, or by the Application of Remedies, these five things mention'd in the preceding Paragraph may be compleated; as may be seen from the best Authors, *Paræus*, *Hildanus*, *Solingen*, *Dich*, &c.

But if they lodge in the internal Parts, they are to be oppos'd by other Remedies, altho' analogous thereto in their final Operations; amongst which since Poisons are the first, we shall first of all treat of them.

ANTIΔΟΤΑ, of Antidotes.

THE quickest Poisons taken into the Body, or apply'd to it, being made the Causes of Diseases by their own proper Strength or Efficacy, or from Corruption, first brought into the infected Parts, indicate first, The taking away of the poisonous Cause. 2ly, The Correction of the Poison now received, or unavoidably to be admitted. 3ly, The Expulsion of it from the Body. 4ly, The Mitigation of the Symptoms. 5ly, The Arming or Defence of the Body, against the force of the Poison taken in or apply'd.

The Cause that spreads or diffuses the Poison, and communicates it to the Body, or mixes the *Miasms* to the Atmosphere, or being now apply'd to the Body, inspires the *Miasms* if this be known to the Senses, it is easily removed. First, By taking away the poisonous matter, and that first of all, by burning it out with large living Fires. 2ly, By correcting the Air, which brings to, and conveys

conveys the *Miasms*, which is best done by thick Vapours arising from such combustible Fuel, the Virtue whereof is opposite to the known Poison, as in the Plague, from caustick, alcalisate, putrid Vapours, the Fumes of Vinegar, Spirits of Salt, &c. in acid, poisonous Exhalations, the diffusing of spirituous, alcalisate Odours are serviceable. 3ly, By changing, dissipating and renewing the Air by a Wind made by Art, especially, if it can be transmitted by large Fires, according to the Art of *Hippocrates*. 4ly, By flying from it, or moving from a lower Situation to a higher or mountaneous Part. Lastly, by taking away or correcting that venomous matter, which is received in or apply'd to the Body.

The present known Poison is corrected by the Application of such things, which can render those Qualities of it unactive, with which it hurts the Body.

Which first, are hitherto scarce known in many of them, except only from the poisonous Faculty hardly evident, unless by the Death of the Person infected. 2ly, They are discover'd in others by their wonderful, and not yet explain'd Effects. 3ly, In some, by those Effects that are to be met with in other remarkable Diseases. 4ly, and Lastly, They are understood in some few from the first Reason, while from the known Nature of the Poison they are easily foreseen.

The former which are said to hurt the whole Substance, accurately *indicate* contrary Remedies, yet equally as little understood as those Poisons, as to the Knowledge of their Effects. These are properly call'd Antidotes, Alexipharmicks, Treacles, &c. and by the Greeks, ἀντίδοτα, ἀντίδοτοι, ἀλεξιπικρα, ἀλεξιφάρμακα, ἀλεξιδήμια, δνείακα, which being only known from Experience, is to be sought for in the History of Poisons.

The

The Second Things said to come from an occult Quality, in like manner, requiring wonderful Remedies call'd Specificks, scarce to be found except by mere chance, are refer'd to the History of Poisons, from whence they are to be fetch'd.

The Third before they kill, while they produce morbid Effects, with which the Fabrick of the Body is so broken, that in certain known Diseases they require, that such Medicines should be administred, which Physick hath been observed to avail in the healing of such Diseases, which distinguish themselves by the like Effects.

If Poisons are known to be apply'd to the Body, then there will be an occasion for administring those Remedies, which have immediate and ready force and Power to enervate and weaken the known Malignity; but these are however strong opposite Malignities themselves, and therefore as likely to do Mischief to the Body, except the Poison that was first there.

From whence we learn to know the Nature of Poison from natural History, and the Cure of Poisons, as well from Mechanical Science, as Chymical, and lastly, from the Effects discover'd by Anatomy. And Knowledge arising from hence judicates this.

And from that *Indication* is known the matter, Preparation, Dose, Application and Direction, or Government of a corrective Remedy.

But the first and most common Antidotes almost against all Poisons, and therefore of the greatest use where the Poison taken is known, but not the particular Nature of it, are these, pure Water a little more than Blood warm taken quickly, and for a time, or else injected into the Body; as also a weak *Lixivium* or *Lee* of common Water and Venice Soap, us'd in the like quantity, manner and time, or else simple Water with Soap and *Oxymel*, administred upon the

like occasion, sweet, fresh drawn Oils by Expression, from fat, farine or frumentaceous Seeds taken in good quantities, and that presently, or injected, or fat Broths made from the Flesh of Animals; especially the Vinegar if soon apply'd, and lastly *Opium*. But there is not hitherto known any General Prophylactick Antidote, but it is repugnant to it self.

In giving particular Antidotes, there is need of the greatest Prudence; for since these prevail by their singular Virtues to correct this or that Poison, they have notwithstanding a force or violence equally as great or greater, than that which they overcome. And therefore these meeting together in the Body, mutually destroy themselves become unactive, and do no great hurt; but if they are there singly, they are found to be equally noxious as the Poisons themselves, which they are administred to Yubdue.

But all these Antidotes whether universal or particular were, may and ought to be so prepared, apply'd and directed, that they may be ready presently and constantly by their uncorrupted Virtues, to pervade those places in which the *Virus* or Poison lodges, and there to conquer and overpower it: Therefore the Physician ought to have a Class or Stock of Materials always ready or at hand, which takes in all the Diversity of Applications, which are first, Air, Fumigations, a dry or moist Vapour apply'd to the Lungs; Draughts, Clysters, *Emplastrums*, Baths, Fomentations, Injections for the Womb, Bladder, Jaws, &c.

Poison being receiv'd, is expell'd from the Body. First, By lessening the Strength of it in that place, by which it may be more safely discharg'd, where it is less hurtful, and passes out of the Body, and does less Injury to the *Viscera*; for then it is driven by the Vigour of Life and the Efficacy of Medicine, till it is forced out; and that is perform'd at this day by means of great, large Cupping Glasses,

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The fierce cruel Symptoms of the venomous Effects growing more sensible, according to the Doctrine of Pathology, are not difficult to reduce to their *Classes*; and then they may be cured, as if they had been some particular Diseases, of which we shall speak hereafter.

But what hath been hitherto said of Poisons, may
be likewise understood of the Plague and other Con-
tagions: But what hath been said, will appear more
intelligible from the subsequent, and perhaps not

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useless

useless Compendium of particular Poisons and their Antidotes.

For first, some Poisons may be refer'd to Things, manifestly acrid, but so that the Acrimony is singular, and yet caustick, creating a *Gangrene* and putrefying; such are *Cobalt*, yellow, red and white sublimate *Arsnick*, *Realgar*, the *Armenian Stone*, *Lapis Lazuli*: These internally or externally apply'd inflame, corrode and raise Pain, Heat, Dryness, first in the Places first hurt, and then in the whole Body, hence they create the most acute inflammatory Diseases in the Mouth, Jaws, Gullet, Stomach and Guts, procuring *Nausea's*, Vomitings, Dysenteries, *Cholera Morbus* and the Iliack Passion; producing a livid Paleness, from whence comes *Vertigo's*, Convulsions and Death, but avoiding the last, Paleness, Palsy and Contractions, they indicate or declare the immediate use of warm Water, Vinegar or Honey, constantly follow'd by drinking, injecting, bathing, &c. If it can be thrown out by Vomiting or Stool, that is better to be repeated often, fat Broths, Milk, Oil and Butter are profitable; after that, they require the daily use of laxative, soft, fat things, as well by the Mouth, as bathing or washing therein.

The like almost of these are from Vegetables, as Aconite, Anacardium, Anemone, Apocynum, Arum, Cataputia, the black Chamæleon, Colchicum, Crown Imperial, Cyclamen, Dragons wort, Spurge, Elaterium, Euphorbium, African Marygold, white and black Hellebore, Hermodactils, Hyacinth, Spurge laurel, Mezereon, poisonous Honey, Oleander, Ranunculus, Ricinus, Scammony, Oily Seeds being made acridly rancid by continual Decay, Tithymal and *Thapsia*; the Effects of which are almost the same with the fore-mention'd, but the Indication perfectly so.

There

There are other violent and acrid Poisons, but yet which lodge as it were Viscous in the Stomach, and so effect the Brain and Nerves after a particular manner, as the *Chrysomel*, the great and lesser aquatick Hemlock of *Gesner* like Parsley, Henbane, Nux Vomica, Oenanthe with the Smallage Leaf, and poisonous Juice, Opium, Nightshade, &c. producing *Vertigo's*, *Scotomies*, *Delirium*, *Madness*, *Nausea*, *Vomiting*, *Dysenteries*, horrible *Convulsions*, *Apoplexy* and *Death*; they indicate the present use of a Vomit ready at hand, Water, Oil, Honey, the *Acidulae* taken in great quantities, and a constant Repetition of them; Baths, Clysters, &c. the Disease being abated, strong Sweats by Treacles and often repeated, then a soft, thin Diet.

There are acrid Poisons with a manifest Acidity; as to wit, Spirits of Salt, Spirit of Nitre, Aqua Regia, Aqua fortis, Spirits of Sulphur and Vitriol, the same Acids united with metallick Bodies, as a Solution of Gold and its Crystals; a Solution of Silver and the Vitriol thereof, the *Lapis Infernalis*; a Solution of Quicksilver in Spirit of Nitre, Spirit of Salt, Aqua fortis, Aqua Regia, or the Calcination thereof with Oil of Vitriol; and hence comes red, white and green Precipitate, sweet and corrosive, sublimate, Calx, Turbith, Mineral; the Impregnation of Antimony with Aqua Regia, and hence the escharotick Calx. From these arise horrid Tastes, acid, sour Stenches, Inflammations, eating of the Flesh, gangrenous eschars Loathings, Vomiting, Dysenteries, dreadful, cruel Gripes, Heart burn, Iliack and Chollick Pains, Tumours of the Glands, Salivations, Syncope's, Death. These require Dilutions by aqueous things, blunting or sheathing the acid points by Oils, inverting them by lixivate, soapy Alcalies, absorbing the strongest Acids; but then when the Violence is appeas'd, the frequent use of Oil and fat Broths, with the Emulsion of the cool, oily Seeds.

There are other acrid Poisons known to be manifestly *alkaline*, and they are the Ashes of burnt Plants or Vegetables, made from thence into an Alcali, as *Lime-stone* is by burning; Egg, Humours and Flesh it self putrefied together, and then the Salts separated from them, are made by Sublimation of the Fire into fix'd Alcali Salts, with *Lime*, *Lapis calaminaris*, *Chalk*, *Iron*, &c. but these create a quick, violent, fiery Inflammation, Corrosion, Gangrene, burning Pains in every Part, likewise unquenchable Thirst, Convulsions, the acutest Fevers, cadaverous Smells, intimate Dissolution of the Humours, Putrefaction of those and the *Viscera*, and lastly Death; but they require in order to a Cure, a Dilution by aqueous Laxatives; an Obtusion by oily, fat and unctuous Earths, an Inversion by diluting, volatile Acids, and afterwards a continued Diet of cooling, acid, oily Emollients.

Some are frequently esteem'd Mortal from a particular Acrimony, yet so that that Acrimony is scarcely otherwise manifest, than by its deadly Effect in Men, Brass, the *Calx* thereof burnt, the *Calx* made by Corrosives, Flowers, &c. Crocus of *Antimony*, the *Calx* prepared by burning, and the Glass of *Antimony* made this way, the Flowers made by the Fire, or made by the help of *Sal Armoniack*, and then wash'd. These taken inwardly procure Loathing, Vomiting, Dysentery, dreadful, cruel Pains of the *Viscera*, *Spasms*, *Tetanus*, *Syncope*, horrid Troubles and Death; they require for Cure diluting, emollient, obtruding Acids presently apply'd, and that for a time upwards and downwards, externally and internally; then Opiates, and oily Medicines.

There are also reckon'd six acrid Poisons, that are merely mechanical; the Diamond, Rock Crystal, Filings of Iron and Brass, plumous Allum and broken Glass; these prick the Nerves, wound the Vessels, excite Convulsions and Hemorrhages, from whence
come

come Ulcers and the like Mischiefs, they indicate the speedy and plentiful use of Oil and Butter.

Those are Poisons which destroy by sudden or slow Death from constringing the Vessels, thickning the Humours obstructed or drying them up; as quick Lime, Plaister, the Minera, Filings or Calx of Lead, Ceruse, white Lead, Glass, Lytharge; Fleawort Seed, Hip Sponge, Toadstools, Agarick, Birdlime, these conglutinate and constrict or bind the Guts and Vessels together, and create miserable Diseases after a wretched languishing Life, and at last Death; they demonstrate the necessary use of Vomits, Purges, &c. of spirituous Acids, oily, spirituous Alkalis, all saponaceous Things, which are to be us'd quickly and with some Continuation.

In the last place, those are to be reckon'd *Heteroclite Poisons*, that are Enemies to Life, yet whose Effects and Virtues have not yet been sufficiently explain'd and well observed, and which notwithstanding, by taking, Application, Stroke, Touch or Biting, occasion Death; as the Cantharides, Spider, Tarantula, Asp, Viper, Serpent, a venomous Worm call'd *Dipsas*, the Horn-worm, Scorpion, mad Dog, Toad, Lizard, the venomous black Beetle, Salamander, the Sea Hare, Sea Parsnip and the like, these produce certain, various, wonderful and unaccountable Effects: The Indication whereof is if internally taken, to evacuate presently by Vomit, but above all to dilute by Water, and soften by laxative, emollient, oily Medicines; and such as resist Putrefaction, as spirituous, acid and saline ones. If they act from an external Stroke, Bile or Application, then the Eduction of the Venom is indicated by the poisoned Part from sucking, scarifying, burning or rubbing thereof; and also promoting strong Sweats by penetrating Antidotes, that are Enemies to Putrefaction, by blunting the Venom by acid, saline, or other specifick Counterpoisons.

There are some things which suffocate or choak the Patient in a moments time under the form of a Vapour, as the Fume or Smoke of Coals, the Damp of a Coal Pit, or subterraneous Air long pent up for want of vent : The Steam of fermenting Wine, the volatile Dust of a ripe *Fungus Toadstool*, or *Puffball*, the Fume of *Sulphur* and the like ; these may be understood from what went before, affect the *Lungs* and *Nerves* when apply'd to them, that they are scarce to be cured.

But the remote Causes of Diseases known to the Senses, are easily changed or removed, for they indicate an Alteration in the *Six Non-naturals*, but if the same are hid, or kept more close, yet being known by their mere sensible Effects ; they indicate by these their *Phænomena* apt or proper Remedies.

For the Course of these *Phænomena* rightly observed, teaches us by what Assistance, Time, Order, Method and Way it is to be used, that the proximate Cause of a Disease in the human Body may be corrected or expell'd.

But also it teaches us the accurate Observation of them, what is wanting, and what those supplemental things are which are to be administred.

And likewise what Motions are to be excited, supported, lessen'd or brought to Rest, in order to promote the same end.

Therefore the appointed and exact Knowledge of Effects teaches us exactly how to correct and remove the Cause.

From whence also is known, that hitherto there is a double way by which we are led into the Knowledge of the Cause, to wit, methodically or specifically.

The methodical way, whereby the immediate Cause is known and taken away, makes use of these Helps or Assistances, first, accurately to explore and appoint the *Phænomena*, and diligently to observe

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observe the Course of Nature. 2ly, If Life is seen to languish or grow weak in the Performance of those things, which are required to drive out the Cause of the Disease, to have recourse to the Administration of *Cardiacks*, or by the Removal of those Impediments which hinder the Evacuation of the preternatural Malady. 3ly, But where the Actions of Life are perceived to rise too much, and therefore rather embarrass than relieve the Cause of the Disease, then such Temperance or Regulation is to be used, that they may be reduced to that degree of Strength as is here requisite; which is effected by aqueous, diluting, soft Laxatives and gentle glutinous things evacuating the material Cause of their Force, as Opiates, Anodynes, &c. 4ly, By acting or changing nothing at all, except what is evidently known to be done from a clear *Indication*.

But those Specificks, which remove the Cause of a Disease by simply applying them as such, gain the Appellations of mischievous Poisons themselves, as well as those of noble Medicines, as the *Peruvian Bark* in the Cure of an intermitting Fever, *Opium* of Pain and the like particular Antidotes that cure any particular Disease, by correcting, attracting or expelling the Malignity.

A healing Indication in the Diseases of a solid Part.

IF the Disease itself lodges in a solid similar Part, being known, it easily shows its own *Indications*.

For if it is united where a Solution or Division is required to the Cure, first, by taking away the foreign or dead matter, placed in betwixt the separate Parts. 2ly, The drawing them out mutually

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to their natural Situation. 3ly, Giving Rest, and not interrupting or disturbing their Co-alition. 4ly, Keeping them in a natural Moistness, Heat, and Softness. 5ly, A Conglutination that is render'd natural by means of a moderate, sound, liquid Nutrition.

The Three first are effected by the Hand of the *Chyrurgeon*, the Fourth by Balsams, Oils and Unguents, that prevent Putrefaction, Balsams of Tolu, Peru, Copayva, Mecha, native Turpentine, Butter, Marrow, *Arcaus's* Balsam, Ointment of Basilicon, Oil of Olive Linseed, &c. likewise Herbs and Flowers infus'd in Oils, &c. as *St. John's Wort*, Vervain, Marsh-mallows, Agrimony, white Lillies, &c. The Fifth is perform'd by prescribing a requisite or proper Diet to the Sick.

Too great Rigidity or Stiffness of the solid Parts indicates, there ought to be a Relaxation of them, which is obtain'd, first, from Fomentations, Baths, Liquors, Injections and Vapours of warm Water. 2ly, By the same means applying a gentle Decoction of emollient Vegetables, of Mallows and Marsh-mallows, Vervain, Acanthus, Pellitory of the Wall, Mercury, Fennugreek, Linseed and Quinces, Wheat and Oats. 3ly, Applying of soft Oils after the same manner. 4ly, By moderate Motion or Exercise frequently used.

Too great Weakness or Relaxation of the solid Parts being known, indicates or requires the strengthening of them which is to be obtain'd, first, by *Cardiacks* as have been already describ'd. 2ly, From greater Motion than ordinary, apply'd to the Body by Frictions and Exercise, that a little more Hardness and Callosity may be gain'd to the Part. 3ly, From a dry Heat. 4ly, From the like Diet and Air.

From which it is plain, what ought to be done in an Encrease or Diminution of Elasticity; in too great

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great Weakness of a Fibre, or too great a Con-
traction or Distraction.

*A healing Indication in Diseases that corrects
the Fluids.*

THE Humours that are observed or taken no-
tice of to be vicious in a Disease, indicate
either the Alteration or Evacuation of them; and
that either in the whole or in one affected Part.

A Vice or Depravity of the Fluid lodging in
one particular Part, always shows either the Tena-
city or Roughness of the Liquid, or else the ill
State and Condition of the Solid, and therefore in-
dicates the Change of the Passage as well as the
Matter.

Matter that is lock'd up in a Place that hath too
little Motion and is impassable, is restored, first, by
diluting warm aqueous things, under the Form of
Drink, Fomentation, Vapour, Bath or Injection,
but so apply'd, that they may be able to remove
the Obstruction in the nearest Part they can be to
the affected Place. 2ly, By resolving saline Medi-
cines in like manner administred; as Nitre, *Sal pru-
nelle*, *Sal Polycresse*; Nitre stibiated, *Sal Gem*, Salt
Armoniack, Flowers of the same, with a fix'd Alca-
line Salt, Borax, the Salts of Vegetables, volatile
Alcalies, soluble Tarrar, &c. 3ly, By *Sapo's* from
express'd Oils and fix'd Alcalies from express'd Oils
and volatile Alcalies; from distill'd Oils and fixed
Alcalies; the Galls of Animals and the Juices of
the absterfive Plants; as Lettice, Succory, Dande-
lion, Sow-thistle, Goats-beard, Taragon, Endive.
4ly, By those which are contrary to, and prevent
any particular Coagulation, as by the Use of Alca-
lies when there is a *Coagulum* made by Acids, and

in a glutinous Coagulation, from the Use of *Sapo's*: In a *Coagulum* from Rest, by the Use of Salts and Soaps. 5ly, By Cardiacks, saline, aromatick, oily spirituous things considered as stimulating Medicines.

An obstructed Course is made pervious, first, By opening the Passages with Drink, Washing and Bathing of warm medicinal Waters, with emollient and saline temperate Medicines, moderate, dry, moist or hot Friction or Rubbing of the Parts. 2ly, The same is made from the broken matter, together with the filled Vessels, by warming, softening, and moving, as Putrefaction and Suppuration, and the Resolution of the whole Part affected into a Fluid, *Pus* or Corruption. This is done by the Meal or Flour of Oats, Linseed, Wheat, Pea's, Beans, Lentils, Fenugreek, &c. as also the emollient Roots of Mallows, Marsh-mallows, Vervain, Melilot, Leaves of *Mercury*, or wild Spinage, Pellitory and Figs; the Yolks of Eggs, aromatick acrid Gums, *Ammoniacum*, *Galbanum*, *Opopanax*, *Sagapenum*, fresh Butter, which are either form'd into *Pultises*, *Ointments* and *Emplaisters*. 3ly, By opening the way for the matter thus prepared; by Section or Cutting with an Incision-knife, or the Application of a *Cauterisk*.

The *Vices* of the Humours, offending in the whole Mass, first, according to the *semeiotical* Doctrine indicate the contrary Remedies; to wit, too much Fluidity requires Inspissating or Thickness, which is acquired, first, by a Diet prepared from the Gelly of Animals and Vegetables. 2ly, From a farine aqueous Drink that is not fermented, as Barley, Water, &c. 3ly, By Encreasing the Action of the *Viscera* by those things fore-admonished for that purpose. 4ly, By the proper Use of *Cardiacks*.

The Thickness of the Fluid, if it offends, requires Attenuation or Thinness, and this is procured, first, by

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by Diet from Meats that are chiefly fluid and light, the Broth of Flesh boil'd with Garden Pot-herbs that are moderately attenuating, as Endive, Succory, Sallery, Cabbage. 2ly, From acrid warm Pickles, as Mustard, Cresses, Colewort, Water-cresses, Nasturtium, Horse-radish, with Pepper, Leeks, Garlick and Onions. 3ly, From old, sharp, spirituous Male Drink, Wine, Hydromel, Brandy, &c. 4ly, By diluting Drinks, Baths, Injections and other assistance of Water and Heat, or the Motion of Running, Exercise, Rubbing, Riding, Walking, &c. 5ly, By strong stimulating Sudorificks, Diureticks, Purging, Vomiting, Blistering, Mercurials, &c. 6ly, By forceable Resolvents, as the fix'd Alcalies, volatile lixivate Salts, and those things which are compounded from them.

But too much Motion of the Humours circulated thro' the Vessels, in secerning or excerning the Fluids, indicates a Rest or Quiet which is procured, first, by removing that particular *Stimulum* which irritates the Fibres and raises that Motion, or else from correcting its contraries. 2ly, By lessening the whole Mass of Fluids. 3ly, By inducing Rest from *Opiates* and *Anodynes*.

The same Motion being too much abated, wants raising to a greater Force, which may be done, first, by removing the Obstacle or Impediment, by correcting and assisting Remedies. 2ly, By the Help of Attenuating and Cardiack Medicines.

The Acrimony of the Humours in general, also indicate in general the Reduction of the Acrimony to be more sluggish and unactive; and this is effected, first, from a constant Diet of those Aliments, that are almost tasteless and insipid, perfect Gelly, soft and oily, as Milk, Bread, &c. the Broth or Gelly of fresh young Flesh, made by Boiling and Expression fresh Fish and Flesh; wheaten Bread well fermented and fully baked, good new Almonds,

Pistachia

Pistachia and *Cacao Nuts*, with the Milk of the latter, Sweet Summer Fruits that are perfectly ripe. 2ly, By drinking of pure Water. 3ly, Rest and Ease of Body and Mind. 4ly, By diluting, watry, soft, mealy, emollient oily things made into *Prisans*, *Emulsions*, *Pomentations*, *Baths*, *Drinks*, *Clysters*, *Injections*. 5ly, By *Opiates* and *Anodynes*.

But the acid Acrimony requires its Correctives, such as are, first, Diet from Eggs, Flesh-meat, Fish, together with Pickles, determining the Humours to become Alkalifate. 2ly, Water-drinks or oily fat Liquors, as Brunswick Mum, Malaga, Canary and Spanish Wines, good old Metheglin, &c. 3ly, Chiefly Rest, as long as there is any great Sourness prevails, afterwards an Encrease of Motion by degrees, and at last pretty strong, together with Cheerfulness of Mind. 4ly, Such Medicines as absorb the Acid, as Crabs Eyes and Claws, the Bones of Fishes, &c. Shells, Pearl, Coral, Chalk; fat Earths, as Bole, Lemnian and seal'd Earth, *Lapis Haematitis*, Dragons Blood, Filings of Iron, &c. or such as convert the Acid into a compound, soft, permeable Salt, as the volatile, fixed, lixivate Salts; likewise those that blunt the Points of the Acids, as soft oily Emollients.

Again, the alkaline Acrimony being discover'd, requires, first, a Diet from the Milk of Animals fed with tender Herbs, the Whey and Butter-milk from the same, as also Summer Fruits. 2ly, Drink from Water or small Beer. 3ly, Rest and moderate Cold. 4ly, Medicines, which by destroying the Alkali, convert that into a soft, compound or neutral Salt, as are almost all the natural Acids, the acid *Serum* or Whey of Milk from Animals, *Churn-milk*, Cream, &c. so those from Vegetables, as Sorrel, Wood-sorrel, Cherries, Rasps, Berberries, Currans, the Juice of Oranges and Limons, Rhenish and Moselle Wines, Vinegar, Tartar and the Cream of Tartar, Tamar-

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rinds, Acacia, &c. those from Fossils, as Sulphur, Vitriol, Salt, Nitre either simple or mix'd with other Bodies.

A *muratic* Acrimony indicates, first, a Diet perfectly tasteless or insipid. 2ly, A spirituous, light, watry Drink that is a little acid. 3ly, Medicaments that are emollient, farinous, diluting and also lixivious, made from quick Lime. 4ly, Those generally which are opposite to Acrids.

An oleous, aromack, bilious, putrid, rancid Acrimony stands in need, first, of a Diet, from the insipid, tasteless, farinous, olerant, acid Fruits, with Meats that are very gentle *Acidula*. 2ly, Drink from Water and the most diluting *Oxymell*, or a Decoction of Fruits. 3ly, Rest and moderate Cold. 4ly, Medicines from Lixiviates that are gently warming, as Honey, Manna, Cassia, Sugar, the fresh Juices press'd or squeez'd from Summer Fruits. 5ly, Things that are generally contrary to *Acrids*.

Whoever understands aright the Fundamentals here laid down in this method of Healing, and hath likewise weigh'd and consider'd well the Works of *Hippocrates* and *Galen* thereon, may perfectly understand the Medicines that are requisite to raise, promote, govern and absolve a Digestion and *Crisis* both in acute and chronick Diseases.

For these consist only in the Attenuation of the thick, the temperating the acrid, in opening of the obstructed Passages, in strengthening the weaker lax Parts, and relaxing the strong and rigid, as also in the Temperature and Regulation of Motion; that the Consent and Opinions of the Antients may yet plainly exist.

For from them we see what hath been the Boasts in every Age, and especially from the Principals of the Chymists, if these *Axioms* are first diligently consider'd from the *Panacea*.

320 *A healing Indication in Diseases, &c.*

1. A *Panacea* acts not or performs its Virtue on a *Cadaver*.

But 2. requires the Motion of remaining Life, that it may be stir'd up to the Exercise of its Power.

3. Also it acts not upon a Part of the Body perfectly dead, yet cohering to the whole, whether it be turn'd into *Pus*, *Ichor* or a *Sphacelus*.

4. But the Extension of its Power or Virtue terminates in Life.

5. It restores not by it self the vital Liquids that are lost or destroy'd.

6. Neither the same being corrupted, does it reduce to a Natural Disposition, as for example, *Pus*, Corruption, a stinking Sanies, or the Matter of a *Cancer*.

7. It restores not the solid Parts that are cut off, wither'd or consumed, either of Vessels, *Viscera* or Limbs.

8. Many and those various Diseases, may arise from one and the same simple, material, efficient Cause, if that is apply'd various ways to different Parts of the Body.

9. There may indeed only from the Motion of the Animal Spirits varied or diversified, many Diseases arise, and be maintain'd, and increase.

10. As from Obstructions only many proceed while Life remains.

11. Lastly, from Spasms or Contractions singly, Wind, small Prickings and Poisons.

He that weighs all these things truly, will clearly and evidently see, that there are many Diseases relieved or cured by one Medicine, but that no Medicine cures all Diseases.

But the Remedies hitherto observed to be most universal, are *Water*, *Fire*, *Quick-silver*, *Opium*.

And practising upon these chiefly, tho' endeavoring cautiously to hide 'em, some have gain'd a great Name

A healing Indication evacuating, &c. 321

to themselves, who were vulgarly believed to possess or be Masters of an universal Medicine.

From hence again, it is plain what are call'd corrective Medicines in Diseases, and whether there are any universal ones.

A healing Indication evacuating from the Fluids.

THE Matter of a Disease, or that which to its Assistance Art indicates must be carry'd off, is to be evacuated by a double Passage. First, By natural Emunctories and Spiracles of the whole outward Skin of the Nostrils, Mouth, Jaws, Oesophagus, Ventricle, Intestines, Bladder and Urethra. 2ly, By artificial means, by *Plebotomy* in the Blood Vessels, *Arteriotomy* or the cutting of an Artery, Scarifications, Leeches; by Causticks and Blistering in the *Lymphaticks*, and in all together, by Issues, Setons, Ulcers and Fistula's.

Hence the first Distinction of Evacuations, is taken from the diversity of the Emunctory, by which they educe the morbid Matter, but the other from the difference of Matter which is carry'd off by some particular Parts.

Sudorificks.

First of all therefore Sweat and the Matter of Perspiration is drawn out from the Body thro' the Skin; the Medicines which throw it out chiefly, are *Hydragoges* or *Sudorificks*; those which educe it in the second place are call'd *Diaphoreticks*, of which there is no great difference, but only in the degree of Action, such are all those things which move strongly throughout the whole Body. 2ly, Those which

in the interim likewise lessen the Resistance in the exhaling Vessels about the Skin.

The first is brought about chiefly by drinking plentifully of warm Water. 2ly, Of fermenting Acids, or the distill'd Spirits of Vegetables, or the most attenuated reiterated Distillations of subtil Fossils; especially if these are drunk mix'd with warm Water. 3ly, With volatile and fix'd Alcalies, diluted with warm Water. 4ly, With all compound Salts dissolv'd in Water, to which we refer to Sapo's; also Crystals from metallick Bodies, or Salts joyn'd to them, or those metallick Parts that are much attenuated, and not too acrid, as *Antimony Diaphoretick*, *Tachenius's* fix'd Sulphur of *Antimony*, *Bezoardic Mineral*, *Mercury Diaphoretick*, *Crollius's* *Diaphoretick Gold*, *Cinnabar* and many others of the like nature, which upon Examination are found either not to act at all, and then are call'd *Diaphoretick*, or else operate from a saline Acrimony lodging in them, and so often promote Sweating. 5ly, From *Aromaticks* endowed with an acrid subtil Acrimony, as are particularly *Wormwood*, *Southernwood*, *Smallage*, *Asparagus*, *Anise*, *Angelica*, *Afarum* long boil'd, *Aristolochia*, *Gum Ammoniacum*, *Burdock*, *Water-cress*, *Betony*, *Cardus Benedictus*, *Calamint*, *Avens*, *Carni*, *Clove-gilliflowers*, *Cantaur* the less, *Cinnamon*, *Saffron*, *Camomil*, *Maiden Hair*, *China Root*, *Dittany of Crete*, *Liverwort*, *Agrimony*, *Mustard*, *Galingal*, *Gentian*, *Hyssop*, *Bays*, *Lovage*, *Horehound*, *Motherwort*, *Balm*, *Mint*, *Nasturtium*, *Origanum*, *Leeks*, *Pennyroyal*, *Rosemary*, *Rue*, *Savine*, *Sage*, *Sanicle*, *Sarsaparilla*, *Sassafras*, *Scabious*, *Scolopendria*, *Scordium*, *Thyme*, *Tansy*, *Paul's Betony* golden Rod, *Nettle*, *Zedoary*, and the Compounds made from hence; as *Treacle*, *Diatefferon*, *Mithridate*, *Diascordium*, *Orvietan*, and many others of the like kind.

But

A

Apopplegmaticks or such things as purge, &c. 323

But the other part of Sweating is perform'd by a neat washing or cleaning of the Skin, by Vapours, Lotions, Baths, Frictions. 2ly, From a Relaxation or Loosening of all the cutaneous and subcutaneous Vessels, which is happily perform'd by a Steam or Vapour of hot Water, apply'd to all the Skin of the Body but that of the Head. 3ly, By increasing of external Heat about the naked Body from the Warmth of a Bed, a vaporous Bath, burning Spirits, &c. By these means, insensible Perspiration, call'd a *Diaphoresis*, is gently promoted.

The Body is prepared for more easy and ready Exercise, and Labour if required, first, by Attenuation, and diluting the Humours. 2ly, From relaxing and opening the Vessels.

Sweat and a *Diaphoresis* are indicated in Diseases, first, from the Presence of the critical Sweat beginning to ease or relieve the Disease.

2ly, From the Thinness of the morbid Matter dispersing, or spreading it self thro' all the Vessels, as in the Plague, the venomous Bite of a Dog, &c. or the most subtil Case of the Venereal Disease, not yet fixed.

3ly, From the particular Temperament of the Sick.

4ly, From the known Epidemick Constitution.

5ly, From various Obstructions, that lodge every where throughout the Body being resolv'd or loosn'd, especially in the subcutaneous Diseases, as *Scab, Leprosy and Venereal Ulcers.*

Apopplegmaticks or such things as purge Flegm from the Head, Nostrils, Mouth, &c.

ALL the Parts of the pituitary Membrane of *Schneider*, evacuate themselves into the Nostrils,

strils, and being distributed into various or different Cavities, secern a *Mucus*, falsely taken for the Pituite of the Brain; this and the humid Matter of the Eyes as well natural as lachrymous; as also the liquid Matter in the *Coryza* or stuffing of the Nose, being thicker in a *pituitous Catarrh*; and therefore this great quantity of Humours or Rheum may be discharg'd as well the by Strength of Nature as by Medicaments.

This Evacuation is indicated, first, from a Heaviness or Stoppage in the Head, a *Coryza*, Catarrh and Sneezing, while a *Pus* or Rheumatick Flegm drops thro' the Nostrils, with lachrymous or weeping Disorders of the Eyes.

2ly, From the Temperament of the Sick, finding great Relief from the like Evacuation.

3ly, From a Revulsion made from the Lungs, in the Catarrh, Peripneumonia, Phthisick and Stoppage of the Lungs.

This Evacuation is raised from a *Fetus, Vapour*, or a Decoction snuff'd up the Nostrils, first, of warm Water long boil'd with Emollients in them. 2ly, Of the same render'd a little more acrid with Honey or Sugar. 3ly, From a Decoction of Betony, Lavender, Marjoram, Rosemary and Rue. 4ly, From these very Herbs roul'd up when green and stuff'd up the Nostrils. 5ly, From every acrid *Stimulum*, as *Sal Armoniac*, Powder of Tobacco, Hellebore or *Euphorbium*; these are *Errhines* or *Ptarmick Medicines*.

This Discharge is stopt if too great, especially if a strong Sneezing and an acrid Running at the Nose attend, first, with warm new Milk, in which Mal-lows are infus'd, snuff up the Nostrils.

2ly, By soft, gentle Fumigations of *Benjamin*, Mastick, Olibanum, Amber, Frankincense; or the milder Aromaticks, as Marjoram, Marum, and Pennyroyal.

Besides

Sialogogs or Medicines promoting Salivation. 325

Besides if this Evacuation be too much used, it brings a pernicious Custom upon the Humours and the Parts.

But since the Nostrils evacuate or discharge themselves thro' the Mouth, and in that are the salivatory Ducts, the *Tonsillæ* and the Membrane of *Schneider*, the Indication first of all is to make Provision by Medicine, such as are *Apoplegmatics* and *Gargarisms*.

Sialogogs or Medicines promoting Salivation.

A Large and artificial Salivation is indicated, first, from such a *Crisis*.

2ly, From the particular Nature of the Disease lodging chiefly in the Glands and the adipous Membranes, but especially in the Cure of the *Venereal Disease*.

3ly, From the Nature of an Epidemick or Universal Disease.

The Body is prepared by a large, sometimes continued Use of the attenuating, diluting, gentle, warm Decoctions of *Scabious*, *Pellitory*, *Burdock*, *China*, *Sarsaparilla*, *Sassafras* and *Sanders*.

The Evacuation is rais'd or promoted, first, by washing or gargling the Mouth.

2ly, By a gentle and continual Mastication or Chewing of any tenacious or tough Substance, as Mastick, Wax, Myrrh, especially if any Acrids are mix'd with those, as *Pellitory* of the Wall, the *Leucanthemum* of the *Canaries* tasting like *Pellitory*, *Ginger* and *Pepper*.

3ly, By drawing into the Mouth acrid and irritating Fumes, as *Tobacco*, *Sage*, *Rosemary*, *Marjoram*, *Mother of Thyme*, &c.

4ly, But chiefly and most egregiously from the Use or Action of Medicaments, which create a

light but continued Loathing, as the taking of a little *Antimony* that is not much emetick, and common *Vitriol*.

5ly, By those things which plainly flux all the Parts of the Blood, change 'em into *Lympha*, and so convert all into a *Ptyalismus* or Spitting; as crude Quick-silver, Cinnabar, a Solution of *Mercury* in *Aqua fortis*, white and red Precipitate, Turbith Mineral, *Mercury* sublimate, dissolved, &c. But the first of these together with warm bathing or rubbing of the Head, Neck, Shoulders and Face promotes that Action.

Too great a Salivation is abated or stopt, or at least mollified, first, by a large constant Use of the softest warm Drinks, as Decoctions of Mallows, and Liquorice in Milk and Water.

2ly, By allaying the *Impetus* or Violence of it with soft, oily anodine Emulsions, adding prudently a little *Diacodium* or *Opium*.

3ly, By revulsing it into other parts by some strong Evacuation, especially *Hydragoges* that purge by Stool. Yet where there is need of the greatest Conduct, lest the Violence of the Motion of this Matter that is always acrid, should rush into other parts with more Danger; wherefore he that divides it best, can command it with greatest Safety.

Of Emeticks or Vomits.

Vomits are indicated, first, from the Stench of the Mouth in a moving, from a certain Bitterness like Gall in the Throat, Ructation, Loathing and Gnawing of the Stomach, with the Appetite falling off by degrees without any Fever attending or visible Cause.

2ly, From a spontaneous or natural Vomiting, together with great Easiness therein,

3ly, From

3ly, From the Nature of the known matter, whether agile or at Rest.

4ly, From the Place affected with Repletion and Obstruction beneath the *Diaphragm*, especially if that Affection be primary and nothing opposes it.

5ly, From the General or Epidemick Nature of the Disease.

6ly, From the Constitution or Temperament of the Year.

Vomits are prohibited from the contraries of these, and the Body of the Patient is prepared for a more easy and safe Vomit, first, by returning the moveable matter by Dilution, Attenuation and Resolving.

2ly, By relaxing and lubricating the Passages by emollient, oily soft things.

3ly, First by letting Blood, if the Body is too plethorick, or too vigorous and strongly agitated.

Vomiting is excited, first, by irritating the Spirits, from some conceived *Idea* that produces the greatest Loathing; or from some unaccustom'd or unusual Motion, as at Sea, &c.

2ly, By irritating the Fibres of the *Throat* and *Pharynx* with a Feather dipt in Oil, or something of the like nature.

3ly, From drinking great quantities of hot Water with Oil, Sugar, Honey or the like.

4ly, From any strong and viscid Acid; as Flowers and Seeds of Dill, *Asarabacca* Leaves, or from the more violent ones of *Cataputia*, *Spurge*, *Cyclamen*, the Flower, Juice and Rind of Elder, Flower and Seed of Broom, both the *Hellebores*, Seeds of *Nasturtium*, *Ricinus*, &c. *Bryony* Roots, *Orrice* and *Tithymal* with Leaves of *Tobacco*.

5ly, From the *Crocus*, *Glass* and Flowers of *Antimony*, the *Regulus*, Substance and Infusion thereof, or the Emetick Wine, *Mercurius Vitæ*, *Tartar Emetick*

and the like, which perform various Effects according to their various degrees of Strength.

6ly, From *Mercury* made acrid by Acids, in which also they are variously distinguish'd, as they more or less abound with acid or caustick Salts.

The choice Dose and Form of these are indicated from the Age, Sex, Temperament, Season of the Year, Idea of the Disease and the Matter to be discharg'd.

It is promoted from plenty of warm soft Liquors, or Decoction of *Carduus Sage*, &c. drunk in quantities and repeated after every Paroxysm or Fit of Vomiting, and is stopt with a Draught of fresh Oil, Aromatics, Opiates, grateful Acids, stomachick strengthening and corroborating things internally or externally apply'd.

Of Purgatives.

MAny things can be evacuated into the Intestines, and therefore by this way there may be carry'd out of the Body, *Saliva*, *Mucus*, or *Flegm* out of the Mouth, Jaws, Gullet, Stomach, both the Biles, the *Pancreatick Lympha*, the diluted or mucous Humour of the Guts, the black biliary Matter of the Blood, *Viscera* and *Hypochondria*, the serous Matter of the Blood as well as the purulent from some critical, Symptomack or morbid Abscess.

This Evacuation is indicated, first, from a Flux of the *Alvus* that is not colliquative.

2ly, From the offending Matter and the Place thereof.

3ly, From a repleted or obstructed Part under the *Diaphragm*.

4ly, From the particular, general or Epidemick Nature of the Disease.

5ly, From Revulsion.

6ly, From

6ly, From the Signs of Digestion.

7ly, From the State or Condition of the Patient.

Purging is forbid or prohibited from the contraries, the matter to be moved is prepared, if there is occasion, from the same thing as the Vomit was.

It is raised, first, from things that dilute and gently stimulate, drank in great Plenty, when the Body is empty or fasting, in moderate Weather, the Waters call'd Mineral, whether *Steel*, *Sulphur* or *Salt*, are such, Whey, the ripe and fresh express'd Juice of Summer Fruits.

2ly, From lubricating things, and also such as stimulate by an easy Acrimony; soft, fresh, express'd Oils, fat Broths, emollient Decoctions, or the Extracts of them, Sugar, Honey, Cassia, Manna, Turpentine, Damask Roses, Gum Ammoniacum, Galbanum, Myrrh, Oppopanax, Sagapenum, taken in a moderate Dose.

3ly, From gentle Acrids, and also that are a little gross, therefore act chiefly in the first Passages, as Prunes, fresh Figs, Currans, Tamarinds, Myrobalans, Tartar, Rhubarb, Aloes, Polypody, *Mercurius dulcis*, &c.

4ly, From *Acrids*; as Asarabacca, Carthamum Seeds, Agarick, Mechoacan, Julep, Turpeth, Hermodactils, Sena, Soldanella, Dwarf Elder, Scammony, Diagridium, Peach Flowers.

5ly, From the most acrid or caustick; as black and white Hellebore, Gamboge, Spurge, Elaterium, Lapis Lazuli, Euphorbium, Mezereon, white, red, yellow and green Precipitate from Mercury.

From this almost innumerable variety of Compounds are form'd into Pills, Electuaries, medicinal Wines, Draughts, &c.

The Choice, Dose, Form, Preparation of which, are indicated, as hath been said before of Vomits, from the Nature of the matter to be discharg'd; from whence they take various Appellations, as inno-

second, Purges are either *laxative* or such as are loosening, *Cholagogue*, that purge Choler, *Pblegmagoge*, Flegm, *Hydragoge*, Water, *Melanogoge*, Melancholy, *Panchymagoge*, or an universal Purger of all the Humour.

This Evacuation is promoted, by Salt, fat Broths, new Whey and the like ; but is stop't by soft, oily, acid, astringent, opiate, spirituous Medicines, or else by Revulsion into some other Parts.

The Evacuation made of the Faces by Clysters, indicate these things.

First, From the place affected.

2ly, The matter to be educed.

3ly, From the Strength of the Patient and his Temperament, and likewise from the urgent necessity of the Evacuation.

4ly, From Dryness, Heat, and too great Motion of the Humours in acute Cases.

5ly, From reconciling the Revulsion and the Refreshment, requisite in the Fibres and in the acrid Humours.

Therefore *Clysters* are various, first, being only to dilute the Parts from Water, Whey, or sweet Drink.

2ly, They are emollient and lenitive from fat Broths, Oils, Decoctions of the emollient Herbs, Milk, Sugar, Soap, Syrups, &c.

3ly, The lighter stimulating Medicines, Salt Nitrous Water, Decoctions of the more gentle Purgatives, and Urine.

4ly, Acrid ones from Decoctions of the sharpest Purgatives.

5ly, The most certain Clyster, from the injected Fume or Smoke of Tobacco.

Lastly, There are *Suppositaries*, which are made of acrid, stimulating things ; Honey boil'd to a Thickness, Sugar, Soap, &c. which may be compounded with

with the more acrid and cathartick Remedies, as necessity or occasion urges.

Of Diureticks.

AN Evacuation or Discharge by the Urinary Passages is indicated, first, from Signs of Digestion.

2ly, From a critical Flux of the morbid matter by the Kidneys.

3ly, From a peccant Saline, lixivate, subtil earthy, scorbutick, purulent matter.

4ly, From the Place affected.

5ly, From the Epidemick Constitution.

6ly, From the Temperament of the Patient accustomed to this kind of Evacuation.

It is prohibited from the contraries, and is excited by the use, first, of great quantities of Water or watry things.

2ly, Of alkaline, fixed, volatile, simple or compound Salts.

3ly, From fix'd, neutral, compound Salts, as Sea Salt, Sal Gem, Nitre, Borax, Alum, Tartar, or terrefaceous Powders, mix'd with the Acid in our Bodies; so likewise the Liquor of Cockles and Oysters.

4ly, From the four animal Humour, Whey, and Butter-milk.

5ly, From the vegetable Fruits of Oranges, Limons, Rasps, Cherries, and the thin Moselle and Rhenish Wines.

6ly, From the acid Spirits of Vinegar, Nitre, Salt, Sulphur, Alum, Vitriol, either simple or compounded.

7ly, From vegetable Roots of Smallege, Asparagus, Carrot, Eryngo, Onion, Parsley, Fennel, Butcher's Broom and Saxifrage, the Fruits of the bitter Almond, and the Peach and Apricock Stone; or lastly, certain

332 *Menagogicks or Evacuations of the Menstrua.*
certain Compounds prepared from some or all of these.

Diureticks are assisted by an empty Stomach, an easy Digestion, gentle Motion of the Body, cold Air, provided there be warmth in the mean time in the *Loins, Hypogastrium, Pubes* and *Perinæum*.

Evacuation of Urine is stop'd or allay'd by the use of mucilaginous, soft Emulsions.

2ly, Astringent and corroborating Medicines.

3ly, By Opiates.

4ly, From a Determination into other Places, but especially from *Sweat*, rais'd and continued sometimes by Motion or Sudorificks.

Menagogicks or Evacuations of the Menstrua.

AN Evacuation of *Menstrual Blood*, or in *Child-bearing*, is indicated, first, from Age.

2ly, From a *Plethora*.

3ly, From whatever Disease is derived from it, and its Symptoms ; as first, in *Child-bearing*.

It is exercis'd or perform'd, first, by determining at the Womb, with Fomentations and Baths of Feet and Legs, *Frictions* often us'd on the *Feet, Legs, Thighs, Hips* ; by *Cupping Glasses* apply'd to all those and often repeated ; by letting of Blood in the Veins of the Feet ; by Emplasters of the fetid Gums laid to the Navel, Thighs and Legs, &c.

2ly, By opening the uterine Parts and Vessels by Baths, Vapours, Fomentations and Injections, and the Application of Internals, as *Birthwort, Motherwort, Calamint, Cardiac, Dittany, Lovage, Marjoram, white Horehound, Mint, Penny-royal, Rosemary, Rue, Savine, Tansey, the fetid Gums, Aloes, Myrrh, Saffron, Borax, Steel, Amber, volatile, alcaly Salts, distill'd, aromatick Oils, &c.*

3ly, By

3ly, By Chirurgical, Dietetic, and Pharmacentick Remedies, which are opposite to the particular Impediment of Evacuation, which are only to be found in proper single Signs in every Species.

The Evacuation is to be stoppt, if it hath exceeded.

First, By Revulsion.

2ly, By Constriction or binding of the Vessels.

3ly, By Opiates.

Of Phlebotomy.

THE letting of Blood within such a Compass, as not to impair the Strength, first, lessens the quantity of the Arterial and Venous Fluid.

2ly, It makes the Resistance of what is moved, less.

3ly, And consequently a Fullness of the Vessels, so that they mutually compress each other.

4ly, Hence from the distended Vessels, the Contraction or Elasticity is restored.

5ly, It rarefies the Fluids.

6ly, It renders them free.

7ly, It resolves and loosens them.

8ly, It prevents Obstructions.

9ly, Promotes the Circulation, Secretion and Excretion.

10ly, Abates the violence of the Blood's Motion.

11ly, Cools and allays.

Hence Blood-letting removes or takes away so many different Diseases, yet produces wonderful Changes.

It is indicated, first, from too great Plenty.

2ly, From too great Resistance given to the Heart by the Humours.

3ly, From a suffocating Motion by too much swelling, from a Quantity or Rarefaction rais'd in the Arteries.

4ly,

4ly, From a suffocating Motion, beginning by too much Extension of the Vessels, in which the very Elasticity of them is destroy'd.

5ly, From the Blood being too dense.

6ly, From the same uniting too close.

7ly, Or thickning too much.

8ly, From those things which are Signs of an inflammatory and great Obstruction, found every where in the Body, being first discover'd by Pain, Swelling, Redness, Heat and Trouble, when at the same time *Sweat* and *Urine* are suppress'd.

9ly, From too great Motion of the Humours thro' the Vessels, or contrarywise too slow a Motion.

10ly, From too great Heat throughout all the Vessels.

11ly, From too great violence of the Blood, moved into any one particular Part; as in *Hemorrhages* and *Fluxes*.

12ly, From known Epidemick Causes.

13ly, From Age, Sex, Diet or Temperament.

14ly, From a *Cachochymia*.

15ly, From assisting the Entrance of Medicines into the Vessels, and also procuring a Mixture thereof, as likewise of exciting or stirring up the strength and force of them in performing the greatest Cures.

Blood-letting is the best, in cutting a large Orifice first.

2ly, In a free large Vein, easily discover'd, at a distance, from Nerves and Arteries.

3ly, In accelerating or quickning the Motion of the Blood, while it flows by a strong Respiration.

4ly, By the Motion of the Muscles about the Vein that is open'd.

5ly, From the Patient's lying.

Preparation is made for the easier Administration thereof, first, from *Friction* or rubbing the Part.

2ly, Fomentation.

It is prohibited in many Chronick Cases, in which many Obstructions and little fluid Blood remains in the Vessels.

2ly, From Age.

3ly, From Temperament.

4ly, From the known Nature of the Epidemick or Endemick Disease.

5ly, From a *Crisis* now otherwise made.

6ly, From the small quantity of red Blood, and the Weakness of the Body.

7ly, From a fresh Delivery of a Woman in Child-bed.

From whence it appears of what Damage to Mankind this Remedy is, if it be either always or never to be administred, according to the Opinion of *Helmont* and others.

Blood to be taken from the *Hæmorrhoidal* Vessels is indicated.

First, From a melancholy Disposition.

2ly, From Diseases, wherein the Fancy or Imagination is affected.

3ly, From an usual Flux of those Vessels, which are suppress'd.

4ly, From an Irruption of Blood by new ways which used formerly to be successfully evacuated by the *Hæmorrhoidals*.

Blood is to be drawn, first, by mollifying the Vessels with warm Fomentations of Water, Oil, Honey, the Emollients of the Clyster kind, Vapours, &c.

2ly, By opening the Veins by Leeches, &c.

3ly, By the use of *Aloes*.

Scarifications act by stimulating and evacuating the Fluid, but *Setons* and *Fontanelle's* or *Iffues*, by a slower Pain, stimulate and prick the *Genus Nervosum*, discharging of *Serum*, and giving a vent to too great Fullness; hence it is plain, where, and when they are indicated.

Medicaments that are stimulating create Pain, Heat and Redness, from an united Motion in the Nerves, and act by a Determination into Places they are directed; from whence certainly they perform the most infinite, and those often the most desirable Effects.

These are commonly understood, first, by strong sticking Plaisters, which being apply'd to any Part, lodge there, till the Part affected reddens, smells and burns; such as *Pitch, Bitumen, Castor, Vine Ashes, Galbanum, Pepper, Pellitory of the Wall, Sal Armoniac.* 2ly, *Mustard-seed* apply'd like Poultice, and left on till a red, hot, itching Tumour appears; so *Briony, Garlick, Nasturtium, Squills, Euphorbium* and *Crowfoot.* 3ly, *Blisters* which are apply'd in the same Form as the former, produce violent Effects. 4ly, Potential Causticks, as lixivate Salts, *Lapis infernalis, sublimate Mercury, &c.* which raise Inflammations and *Eschars*; lastly, an actual Cantery of burning Iron.

A Palliative Cure.

BY mitigating the *Symptoms*, there is always something taken away of the primary Disease; from curing all the *Symptoms* together, the Disease it self is almost intirely cured.

But first of all, we are to consider Thirst, Pain, too much waking or want of Sleep, and the *Lipothymia*, or *Fainting* of the Spirits.

Thirst, from a Dryness of the whole Body is quench'd or abated, by a large, frequent Draught of Water, Beer, or some grateful Decoctions mix'd with a little Acid, as Barley Water, Whey, Milk and Water, small Punch, &c. thin Water-gruel, Chicken or Veal Broth without Fat; so likewise Baths, Fomentations and Clysters, are useful.

Thirst,

Thirst, from the Dryness of some particular Part, as the Mouth, Tongue, Throat, Gullet, is relieved, first, by the use of the foregoing things. 2ly, By washing and gargling often with the same. 3ly, By opening the Glands and Salivatory Passages by *Epithemums* and Fomentations, of laxative, moistning, and aperitive Remedies.

Thirst, From a lixivious, acrid Salt, or from an aromack acrid is cured by all these, especially those of the diluting kind, but chiefly if the *acid* and *nitrous* are mixed with them; from whence we may know how to appease that which arises from a *muratick Salt*.

But if Thirst arises from an uncommon matter, as swimming, &c. it is to be removed by diluting and resolvent means.

Pain is to be allay'd as a *Symptom* first, by diluting the *Acrid* which is done with warm Water, Water-gruel and the like, apply'd by way of Drink, Forus, Clyster or Bathing,

2ly, By loosening or relaxing the nervous Vessels, by drinking, washing, bathing, or Injections of moistning, loosning Anodynes that are gently aperitive.

3ly, By correcting the *Acrid* it self with proper Remedies.

4ly, By freeing or setting the obstructed *Acrid* at Liberty, from the too great Pressure of the Vital Humour.

5ly, By mollifying, digesting and depurating the obstructed *Acrid*.

6ly, By blunting the Senses with a Numbness, by the internal Administration or external Application of *Narcoticks*; such as are first of all the most gentle ones of the Flowers and Seeds of the *Corn Poppy*; Lettice, when full of Milk in the Summer time. 2ly, The ripe Heads of the Garden Poppy, gather'd be-

fore the Seed is dry; the Milk that drops from the *European Poppy*. 3ly, The stronger Narcoticks of *Theban and Oriental Opium*. 4ly, The strongest and most deadly kind, as *Mandrake, Nightshade, Water Hemlock, Stramonium, or prickly Apple, Henbane, Tobacco* and the like; from all which are made external Applications, as Fomentations, Stoops, Emplasters, Cataplasms, &c. internally, Waters, Tinctures, Syrups, Pills, Confects, Opiates, as *Diascordium, Venice Treacle, Mithridate, Orvietan* and many others.

Too much waking that seizes the Brain it self, causes that great difficulty by which means they never go to rest; except the Disease that first seiz'd the Head be removed, as is plain in a *Frenzy, Coma, Melancholy* and *Madness*.

If they proceed from too great Dryness, they are reliev'd by Diet Drinks, Baths and Injections, from emollient, laxative things, made use of for some time; of which kind, *Mallows, Marsh-mallows, Violets, Lettice* and *Succory* are preferable.

If the *Symptoms* arise from any particular *Acrid*, they are taken away by the Cure of the *Acrid*.

But if it happens that the Humours are strongly and too rapidly thrown into the Brain, the Cure is perform'd. By things that appease or abate the *Symptoms*. 2ly, By Applications, of *Fomentations, Baths, Blisters, &c.* to the lower Parts; these are compos'd of Emollients and Acrids mix'd together; as *Wheat, Barley or Oat-meal, Salt, Vinegar, Leeks, Garlick, &c.* likewise *Fish, and raw Flesh* of *Beef, live Pidgeons* and the like. 3ly, Repellers apply'd to the upper Parts more immediately affected, as *Vinegar* alone, or made with *Elder, Roses, Violets, &c.* Oyntment of *Populeon*, the *Anodyne Oils* of *Nightshade, Violet, Poppy* and *Hembane*.

Internal

The Conclusion.

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Internal *Opiates* may be scarcely used in this Case, except the Disease proceeds from too great Motion of the Spirits, in which condition Regard must first be had to Evacuation and Dilution.

The Excretions being too large are stopt by those things, which promote the Evacuations another way, in the Nature of *Revulsion*.

Too great an Excretion of Blood by the *Arteries* being wounded, or the larger Veins, is stopt by Compression, binding, burning or searing up the Mouths of the Vessels, inspissating or thickning the Fluid, and the Contraction of the Solid; where Spirit of Wine, and ætherial Spirit of Turpentine is, be consider'd in the first Place.

Lipothimia's or Faintings arising from the stagnant Humours, and from spasmodick Pains are cured by diluting and relaxing; but if they proceed from the Vine of the torpid Spirits, then by stimulating Cardiacks: If from Evacuation they are cured by Repletion; if from *Hysterick Suffocation*, then by fetid *Anti-hystericks*.

The Conclusion.

WE Have hitherto treated of almost all Sorts of Medicines, answering to all the several Causes of Diseases, it remains now that we shew in what Order and Method they should be applied to every Intention of Cure, but as Medicines in general, so the Foundation of Practice turns upon the Motion of the Blood, and the Disposition of the Solids, which not only at all times defend the Body free from Corruption, and falling to decay, and so consequently maintains Life, but also expells

these Causes that are Enemies to it, and the morbid Affections thereof.

Hence it was the Antients term'd Nature the best Physician, this Experience confirms, while the vulgar and those who use Physick or Medicines without Art, only consulting Nature free themselves from many Diseases; hence it comes that the common People have better Success, from making use of the simple Decoctions and Infusions of Herbs and Roots, than the labour'd Chymists with their vain, boasted *Arcana's*, which frequently disturb the *salutary* and *critical* Motions of Nature, rather than promote them.

The Instrument of every Disease is nothing but Motion, which is increas'd in the System of the Fibres, from whence Spasms arise, or else in the Vessels from whence the *Fluids* are driven swiftly thro' them, and procure *Fevers*, notwithstanding nothing is a greater Enemy to Life, than the *Stasis* and Rest of the *Fluids*, for this tends to Corruption, whereby the whole Body or a Part of it dies, therefore Rest is diametrically opposite to Life; but by the increase of Motion the stagnant Humours are resolved, and return to Motion, the Obstructions are removed, and by the *Vital Circuit* in this Motion, driven thro' their proper *E-munctories*.

But at the same time we ought not to imagine, that there is any Knowledge or Conduct conceal'd in the moving Fibres, which points out the Seat of the morbid Cause, and according to the degree or proportion of that, institutes and appoints certain Times and Seasons, and directs us to them; such a Supposition is groundless and unnecessary: But this human Machine is so artfully framed, that it is stirr'd up or excited to Motions and Actions of a different Nature, by means of its Fibres, which
instrument

instrument of Motion is *systaltick*, from which afterwards according to the Laws of Mechanism, result various *Symptoms* and preternatural Affections throughout the whole Body.

Therefore in that the Wisdom of the Creator is to be admired, that those preternatural and morbid Motions produced from other Causes in the moving *System* of the Fibres, should sensibly afford Relief and Help to the Body, defend it, and at the same time serve to expell the morbid Cause; so that those morbid Motions not really by themselves, but by accident become *salutary*, and from a thing evil in it self produce a good Effect.

But there are in the whole *Spasms* and also *Fevers* of that Nature, that they perform a salutary Effect on the Body, while they remove and take away that which is offensive and troublesome to the Body, either in Quantity or Motion, too much Fluid, a *Stasis* contracted, and Putrefactions are dangerous to Life.

Now if the Blood be preternaturally increas'd, it excites or raises Contractions by distending and pressing on the Fibres, or it increases the Tone and Motion of the Fibres, which is contractile and proper to the Fibres; from hence the Pores and Vessels are clos'd and tyed up by the Contraction, the excluded Blood is driven forward with force to other Parts void of the Contraction, the Quantity of which afterwards, too much distending the Vessels, breaks forth, and so the Blood is thrown out with great Relief to Nature.

Such an Evacuation of Blood is call'd *critical* and *healthful*, nor is it so without any reason, for it lessens the quantity of Blood, which threatens the Body with a Disease, for this reason, the *Menses* in Women, the *Hemorrhoids* in Men are counted

salutary, and ought not to be impeded or stop'd by the Physician.

When a Quantity of *Serum* flows, and that being salt and impure is obstructed in Perspiration, *Spasmodick Contractions* are made in the Habit of the Body, and the whole Mass of Humours repell'd to the inward Parts; from whence by a large Flux of Humours the Mouth of the Glands are relaxed, and so abundance of vitious *Serum* is evacuated with Advantage; hence *sore Mouths*, *Cough* and *Catarrhs*, prognosticate Health, because they free the Body from a *Superfluous, Salt Serum*.

Plenty of *acid Bile* and *Lympha*, thrown upon the Guts and Stomach, or of acid viscous Humours, excites vomiting by offending the nervous, muscular Tunicles of those Part, or else a critical *Flux*, which is not stop't without some danger. The *Lympha* being very *acid*, *caustick* and *putrid* in the *Small pox*, or something milder in the *Measles*, and likewise the *viscid Tartar* that is in Rheumatick Diseases, disturbs the whole *fibrous* and *muscular Genus*, and inwardly produces strong *spasmodick Contractions*: From whence we have *Heart-burn*, *Vomiting*, *Diarrhea*, *Trembling*, *Cold*, &c. but these dismal *Symptoms* will disappear in the *Spasms* of a *Fever*, wherein the Excretions are perform'd vigorously.

In *Inflammations*, the Blood being pent up in the Vessels, hinders the Freedom of Circulation, where finding no way to return, it distends the Vessels and presses upon the Fibres; from whence in the first place, comes a *Spasm*, by and by from the *Spasm* a *Fever*, which in like manner, successively resolves Obstructions in the Parts affected, loosens the Coagulation of the Blood, and so frees the Body from a great Oppression; but all acuter Pains have for their Attendance a *feverish Commotion* in the Blood, which
after-

afterwards are reliev'd by giving a free Circulation to the *Fluids*.

From these things we may be sufficiently taught and instructed, that Nature is the best Physician; therefore in her method of Cure, she hath always regard to the Parts first affected, and 'tis the Physician's Business to follow that Rule, and by no means hinder, but rather forward her laudable Designs, at least imitate them; for the Physician is not Master but the Minister of Nature, she is Director, he a Servant.

But this ought to be observ'd in spasmodick and acute Diseases, to carry off the vicious Matter, if it offend in quantity, or swell the Parts, which may be done at first without diminution of Strength by Phlebotomy, Purgatives and Emeticks, which are to be prudently and sparingly us'd in the Termination or Ending of a Disease, but not to be neglected upon the first *Accession*; for it is much easier to relieve Nature of a Burden that hath been but just laid upon her, than assist her when the Disease hath had its full Scope; from whence the correcting of a vicious Quality is of great difficulty; for there are but few Medicines, that will change the Nature and Substance of the offending Matter; but the Humours are to be diluted and thicken'd, from whence too irregular a Motion is to be allay'd and temper'd; and Evacuation is much better promoted by a mild and gentle Motion; for if Nature is deficient in expelling, or if it is weak, then she is to be corroborated with *Analepticks* and stimulated by *Alexipharmicks* and *Cardiacks*, which ought to be done about the critical time of Excretion.

This method chiefly obtains in *acute Fevers*, when there is no contending with multiplicity of Medicines, but Patience, Observation and a prudent

Regimen avail more than all the pompous and labour'd Preparations of the Shops. 'Tis a wise and ancient Saying, that the Physician ought to be either a *Spectator*, an *Assistant* or *Actor* in a Disease, or at least he ought to imitate Nature if possible.

He ought to be a *Spectator* in *acute Diseases*, where the offending Matter is not so malignant, but the Vigour of Nature gently performs the Secretions; so *small Pox*, *Measles*, *Catarrhs*, *gouty* and *rheumatick Fevers*, *St. Anthony's Fire*, *Diarrhea's* and other Excretions, do not always require the Physician's Assistance, but they are often successfully cured by the Strength of Nature; here she prevails over Art, so that the latter wou'd rather interrupt than assist her in a Work of her own Power; therefore it is better that the Physician be here a *Spectator*, than too busy an *Actor*.

But when the offending peccant Matter is of a worse and more malignant Nature, so that it raises *symptomatick* Commotions in the *genus nervosum*, that the Excretions of all kinds are disturbed, then Nature is to be assisted; which is to be pursued till the ill quality of the Matter be temper'd, corrected and fitted for a Discharge or Evacuation, and the irregular frustraneous Motions quieted and allay'd; such as these are which frequently happen in all kinds of *Spasms*, *inflammatory Pains*, *periodical* and *malignant Fevers*.

A Physician ought to imitate Nature, if she be slothful and unactive, or else there be a Deficiency in Motion and she is not able to perform her Functions, that is, if there be a preternatural quantity of Blood and Humours, then Phlebotomy is profitable for exciting the Motion of the Fluids and increasing the Secretions and Excretions, and this ought to be done in *Pleurisies*, *Angina's*, *erysipelated*

siplated and all periodical Fevers, Asthma, Scruvy, Palsy, Convulsion, &c. where the Physician's Skill and Application is needful, Nature not being sufficiently able to help herself.

'Tis observable in general, that Nature in *acute Diseases*, and in the *Paroxysms* of chronick ones, performs more than Art, but Art excels Nature in removing the chronick. Now if I should fix upon a Class of those Medicines which are most efficacious in curing chronical Diseases, it would appear plain, they relieve no otherwise than as they increase the Motion in the *Fluids* and *Solids* of the Body, and render them more intense.

These things are exemplified in the Decoctions of the Resinous and Alexipharmick Woods and Roots, and in some Preparations of *Mercury* and *Antimony*, which being apply'd with a judicious Hand, happily and successfully break the Force and Virulence of the Venereal Disease with its worst *Symptoms*.

And there is no other Cause than this, that these Medicines act upon the *Solids*, that is, the moving Fibres, by stimulating the Motion of the *Fluids* thro' the whole System of the glandulous Pipes; so Obstructions are removed, the tenacious viscid Matter discuss'd, and the putrid *Sordes* or Filth of the Body evacuated by the salivatory Glands and the other Emunctories. Medicines from the vegetable, alcalious, volatile Salts and Spirits work kindly with Nature, because they assist the Motion of the Blood and Humours, and push them on to their necessary Excretions; so the lixivate, bitter and balsamick relieve *Dropsies* and *Oedematous Tumours*.

The Effects of the *Acidulae* and *Bath-waters* are wonderful in dissolving Obstructions in the *Hypochondria's*; in removing viscid pituitous *Asthma's*,
Arthritick

Aciditick and *Tartarous* Diseases, but this Operation depends only on an intenser Motion, which they introduce into the Fluids; the mineral Particles of the Water stimulating the *Emunctories* and Strainers of the Glands. The Use of *Chalibeates*, is not of the least moment in Affections of the lower Region of the Belly, and where the Force and Strength of the *Viscera* are lost, and there is a Stoppage of Blood and *Serum*, nor is it according to the Opinion of some that *Acrids* perform such Cures by absorbing the vitiated *Serum*, and precipitating the *Fæces*, but it is done only by the Increase of Motion which they bring to the *Fluids*, from whence, by the Use of them, the *Pulse* is made quicker, the Face more lively in Colour, and the Appetite is strongly raised.

Emeticks circumspectly administred, relieve obstinate Diseases, not only by Evacuation, but by the Commotion they raise in the *Genus nervosum*, by which means it comes to pass that the peccant Matter is disturbed and removed from its former Lodgment; so strong *Catharticks* if they agree with the Body, make the *Pulse* quicker, increase Heat, and produce an Intenseness of *Thirst*.

From which things it is clearly manifest, that the Physician ought to administer and dispense his Medicines purely mechanical; for where the Motions proceed well and regularly, they are to be continued so, and not disturb'd; if they are too strong, they are to be moderated; if too weak and languid, they are to be rais'd and encouraged, on the Management of which the Foundation of Practice turns.

But further Experience teaches us, that *Spring* and *Summer* time when the Air is serene and temperate, gives much more Assistance to the Cure
of

of Chronicks, than *Autumn* and *Winter*, because the Motion of the Blood, and the Excretion of the superfluous Humours is then greatest; such Observations as these wonderfully second the Operations of Medicines, which is made under a languid Motion. But the Antients us'd wisely to take notice of a good or bad Constitution, and to proceed accordingly; a good Constitution proceeds from the Strength and Vigour of the Fibres and a due Perspiration; a bad one from the difficult Procedure of the Excretions, a Want of Strength, or the Vicioufness of the Fluids.

That Physician errs who preposterously stops the salutary Motions of Nature, which are endeavoring to perform their own Work, such as are made from a quantity of matter fecerned, so likewise when he thickens the Humours and lessens the Excretions; for which reason 'tis wonderful to observe how much Physicians mistake in giving *Anodynes*, *Opiates*, *Steels*, *Astringents* and other incrassating things. They offend against common Reason, who, where the Motions are excessive, use strong *Sudorificks* and stimulating *Evacuatives*; they are notoriously to blame, who, where Strength is deficient, exhaust it the more by Purging; and those are equally blameable, who, in an apparent want of Blood, use *Phlebotomy*, &c. nor are those to be commended, who have not that due regard to *Plethitude*, as to make necessary *Evacuations*, especially in the beginning of *acute Diseases* and out of the *Paroxysm* in *Spasmodick*, as *Convulsions*, &c.

They are liable to the same Censure, who, before Evacuation, treat the *Plethorick* and *Cachymick* with forcible Medicines that raise Commotions in the Body, and those who use *Astringents* where there is a great Torture and Contraction of the Fibres, who

who in great Solutions or Relaxations of the Tone, apply cold, moist, nitrous Medicines.

They who suppress *critical Excretions*, either by internal cooling Anodynes, or else stop the Pores by external Astringents, are as ignorant as they who in the *Hemorrhoidal Fluxes*, and the *Menstrua* have no regard to Circumstances. They who in *acute Diseases*, go too precipitately to work, not observing critical Times and Seasons, they compel Nature to Excretion.

But they offend most of all, who use great quantities of Medicine where few will do, for these neither understand the Disease, the Patient nor the Remedy; for there are but few that a Physician need to use, nay very few, whose Virtues and Doses are truly known and thoroughly try'd, therefore he ought to take heed that he apply but few, and that those be choice and well prepared.

They mistake the Matter wide, who in Healing have not respect to the first Seat of the Disease, and they as little in the right, who know not how prudently to correct the vicious Disorder without injuring or destroying the Tone of the *Stomach* and *Intestines*; lastly, they must be thought unworthy the Name of a Physician, who cannot distinguish the *Symptoms* from the Disease, and know what things are done by Consent, and what are the Effects of the morbidick Causes, but proceeds to cure *palliatively*, by attempting to remove the Effects, without understanding to eradicate the Cause.

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